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ABSTRACT

This document contains papers on instructional technology research from the SITE (Society for Information Technology & Teacher Education) 2002 conference. Topics covered include: professors share their thoughts and feelings with their students; faculty reflections on teaching online; integrating technology into preservice teacher education; results of a student attitudinal survey; optimizing informal learning experiences in the home and school; instructional design strategies for summer online courses; advancing teachers through stages of adoption of technology in the classroom; teaching technology infusion to inservice teachers; assessing and predicting information and communications technology literacy in education undergraduates; impact of the Gates Foundation's Teacher Leadership Project; simulating and evaluating the Yekioyd methodology; effects of training in an interactive television environment; influence of gender, grade level, and teachers on the selection of mathematics software by intermediate students; why some African American youth's selves are driving the digital divide; using technology to encourage motivation and achievement in academically at-risk secondary students; a Web design project adopting the constructivist model; the relationship between school and teacher variables and students' usage of technology; deepening the impact of technology through an inquiry approach to teaching and learning; teaching activities through the Internet at Anadolu University (Turkey); using information visualization to enable teachers to search and teach with the Internet; influence of home access on attitudes, skills, and level of use for teachers and students in technology integrating classrooms; computer-mediated discussions of a multimedia case study of mathematics teaching; renewal of teacher education through networked learning communities; effectiveness of statistical training with computer simulation; educating the future generation; the role of intelligent tutoring systems in education; supporting classroom discourse with technology; effectiveness of a planning strategy for online course development; effects of computer use on intrinsic motivation for continued study of a content area; a national online survey of education faculties' use of technology in preservice teacher education courses; stakeholder perceptions of the use and value of computers and technology in an elementary school setting; evaluation of motivation, interactivity, and learning styles in Web-based instruction and online courses; institutionalizing technology in schools; comparison of measures of achievement and interactive technology use in distance education; effectiveness of two models of technology integration in a preservice teacher education program; use of qualitative methods in program evaluation; children's use of the Internet at home; and technology resistance and barriers. Most papers contain references. (MES)

Research (SITE 2002 Section)

Reagan Curtis. Ed.

RESEARCH

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Technology use in teaching and learning has come to be regarded as essential for the future of educational institutions at all levels. Researchers strive for a better understanding of technology's effects as it continues to gain prominence in education. This year's SITE conference papers contribute to this understanding. The quantity of submissions has more than doubled this year attesting to a deeper recognition of the need for critical evaluation of Instructional Technology (IT). This section includes papers addressing the comparison of online and traditional methods for instruction, technology use in practice, competence with and use of technology, perceptions related to technology, as well as theoretical and methodological issues related to research in IT.

My perception is that research in IT has often begun with the unexamined assumption that technology use is inherently good. As such, I find a need for more research comparing technology to traditional methods. This type of research highlights the idea that various forms of technology should only be used if they are more effective tools. I would like to see more of this type of research in future SITE conferences thereby helping educators to determine both when technology is appropriate and what forms of technology are likely to be most beneficial for meeting their goals. This year's contributions include papers that compare online and traditional or face-to-face methods. Jerry Galloway works with middle school students studying African American cultural heritage and Merry Boggs focuses on high school computer science students while the rest of the authors work at the university level. Yusef Koc, in mathematics, and Barbara Coppola, in teacher education, each focus on how discussions can be influenced by IT, while Sherri Restauri and Rosa Ponce each do broader campus-wide comparisons.

The papers dealing with the effects of technology use in practice without making comparisons to traditional methods describe the effects of a wide variety of technologies, in several educational contexts, and from many different theoretical perspectives. Papers in this category include those by Simon Mochon, David Lane, Donna Russell, Tiffany Koszalka, Marino Alvarez, Kimiko Isono, Tianguang Gao, Yahya Mat Som, Neal W. Topp, Sue-Jen Chen, Margarete Juliana, Max Louwerse, Therese Laferriere, Robert Bracewell, and Isil Kabakci. IT such as spreadsheets and simulations, web-based methods, discussion lists, electronic journals, intelligent tutoring systems, and networked learning communities, are examined among others. These technologies are predominately examined in math and science education, but there is also an interesting piece on music education. Readers of this section should appreciate the emphasis on empirical data combined with a diversity of theoretical backgrounds including socio-cultural and ecological perspectives, constructivist theories, action research, and inquiry-based education.

Papers focused on the level of competence with and use of technology help describe the current level of computer, Internet, and software use by elementary and secondary students, as well as the level of computer literacy and technology use by pre-service and in-service teachers. These include offerings by Myka Raymond, Pamela Petty, Donna Ferguson, Toni Jones, Helen Brown, JoAnne Davies, Kay Gibson, Nan Li, Gerald Knezek, Rhonda Christensen and Yu-mei Wang. Some of these papers include discussion of attitudes and beliefs related to technology, but not as the primary focus.

The papers dealing with perceptions related to technology include research on perceptions, beliefs, and attitudes of a wide variety of stakeholders on a diverse set of topics. This category includes articles by David Dean, Jesse Foster, Amy Staples, Mary Lane-Kelso, Beth Coghlan, Glenda Rakes, Kathy Bohley, Dale Magoun, Debra Sprague, Seung Jin, Kimberly Berg, Rita Dobbs, Melissa Mohammed, Prentice Baptiste, Christian Penny, David Pratt, and Misook Ji. These articles discuss research on perceptions related to the Bill and Melinda Gates Foundation's Teacher Leadership Project, the "Digital Divide" and "Digital Schools", integrating technology into teaching, PT3, using interactive television environments and the Internet, as well as other timely topics. The perceptions of pre-service and preschool through university in-service teachers, kindergarten through university students, and university administrators are focused on to better understand the effects of IT across many educational contexts.

The papers categorized as theoretical and methodological issues related to research in IT include those by Betul Ozkan, Fidel Salinas, Steven Dickey, David Moursund, Tammy McGraw, and Chih-Hsiung Tu. These authors cover wide-ranging issues including statistical applications, ethics, online presence, and future directions for research in IT.

Dr. Reagan Curtis completed his Ph.D. in Education at the University of California at Santa Barbara and is currently an assistant professor in educational psychology at Northwestern State University. He currently teaches courses in human development, research methods, and statistics. His research interests include the development of quantitative knowledge from infancy, cross-cultural mathematical development, online teaching and learning, and teacher education.

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Two Professors Share Their Thoughts and Feelings with Their Students

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Abstract: Lecture dominates the medium that is used to communicate facts and concepts to college students. Often these facts and concepts are either misunderstood or take on meanings not intended by the lecturer. Unfortunately, there are very few avenues that students can pursue to clarify misconceptions other than infrequent question-asking or a visit during office hours. Likewise, professor feedback is delayed until end-of-the-year student evaluations that does not remediate faulty logic and serves little purpose in reclaiming clarity of thought and negotiation of meaning of the curriculum. This paper describes how electronic dialogues can illuminate the degree of student understanding with course content.

Introduction

Exploring Minds is an active electronic venue for professors, teachers, and students to reflect, negotiate, and evaluate the teaching/learning process that enables systemic changes to occur under meaningful and thoughtful circumstances. Ideas are revealed in narrative and visual formats through electronic journals, mapping conceptual arrangement of ideas, and V diagrams so that metacognitive tasks such as self-monitoring, reflective and imaginative thinking, and critical analyses are a crucial part of the learning process. The basic premise that underpins Exploring Minds is that the mind deals with meaning and meaning is the basis for conceptual understanding of facts and ideas. This paper describes the dialogic exchanges that took place between two professors and their undergraduate students during a semester via journal entries in a teachers education methods and a physics class.

Knowledge that is isolated into compartmentalized units of study does little to advance the interest and curiosity of teachers and their students. This type of learning reduces knowledge into capsules that are sorted by topic with the ultimate purpose of retrieval by testing. Nowhere does this type of compartmentalized knowledge occur than in college classrooms where the professor lectures and students dutifully take notes for later retrieval on an examination. Facts become valued over ideas due to expediency and an attitude of getting through the required course at minimal expended thought. Understanding is sacrificed for knowing in this type of classroom setting with little professor/student exchanges taking place outside the walls. The professor relies upon end-of-the-semester student evaluations to determine student perceptions of course content and delivery of information; however, in many cases these comments cause minimal, if any, changes in course preparation, adjustment, or course restructuring.

This paper focuses on electronic interactions between two professors and their students during the course of a semester. For this study, we used the action research paradigm grounded in the reality of classroom culture and under the control of teachers. In this study, the events consisted of electronic exchanges that were initiated by the students who were asked to reflect and enter narratives that expressed their thoughts, feelings, and questions resulting from the class session and their assigned readings. These entries took the form of a mental task similar to a diary entry where students were asked to carry on a dialogue with themselves concerning the happenings during class and assigned readings.

Theoretical Framework

Teaching is an exchange of facts and ideas engaged under meaningful circumstances in an environment that goes beyond simply telling and assigning. These facts and ideas should relate to topics, problems, situations, and contexts of a given discipline that take into consideration the experience and world knowledge of the students. However, our position is that these facts and ideas should not be confined to one subject discipline in which the teacher and students are assigned, but rather serve as the anchor from which other disciplines are incorporated so that relationships among them can be readily ascertained, acknowledged, and assimilated.

Our view is predicated on our belief that monitoring student progress and understanding keeps us better informed about our teaching practice, the value of our course content, and takes into consideration Gragg's (1940) warning that "wisdom can't be told." It is also consistent with Gowin's (1981) theory of educating and Ausubel's (1968) theory of meaningful learning. Our theory guides us when interpreting the findings of our research projects and others so that better communication and understanding of the key concepts occur with the "live" audience who weigh the merits of their learning derived from these discussions, assigned readings, assignments, and their applications.

Faculty and Student Use of Computers in the Classroom

A case study involving faculty at Stanford University indicated that computer use by professors primarily consisted of preparing documents used for instruction (e.g., handouts, email listservs), and when researching for personal writings. However, using this same technology in their daily teaching was negligible (Cuban, 2001).

We should also note that professors who teach using distance learning labs or classrooms are not engaging in faculty use of technology for instruction rather it is a way to dispense information "live" rather than tape-delayed through video (although we acknowledge that this method is sometimes also disseminated through distance learning classrooms.). These uses of technology become methods of conveyance rather than uses of technology to monitor self-learning. Instead we depict a network that provides teacher/student monitoring of classroom practice with journaling, and student use of metacogntive tools of concept mapping and V diagrams.

Computer access does not necessarily equate to computer classroom use, but it does indicate that students having computer access to the Internet does imply engagement for personal use and induces student learning brought about by the societal, informal, curriculum than by the formal, school curriculum. For example, Cuban (2001) found that students' use of computers were peripheral to their primary instructional tasks, and that less than 5 percent of the middle and high school teachers integrated computer technology into their regular curricular and instructional routines. When teachers in their classrooms used computers these computers did little to alter the existing teaching practices already in place (see Cuban, Kirkpatrick, & Peck, 2001).

Perhaps it should be noted that technology systems that have been developed for school use are done so by persons who have little knowledge or experience of what it is like to teach at elementary, middle, secondary, or postsecondary schools. This position also encompasses the social, cultural, organizational, and political factors of the school environment that shape the complexities of what people do in this milieu.

Our Exploring Minds Network was developed at the Center of Excellence for Information Systems, Tennessee State University, from a teacher's perspective with classroom experience at the middle, secondary, and postsecondary levels that includes management, interactive communications, monitoring, and metacognitive tools (Alvarez, 1998). The network includes collaborations with researchers, parents, coordinators, and guests as deemed necessary by its users.

Finding Out What Our Students Know and Understand

Keeping abreast of how our students perceive the course content is a key component of pedagogy. How are we, as professors, to know the extent to which our students are processing new information in meaningful ways that are deemed to be acceptable rather than in ways that may be either misconceived, confusing, or relegated to rote memorization?

In order to promote learning and understanding that go beyond the walls of the classroom and result in reflection, we used electronic exchanges with our student to reveal their feelings and thoughts as well as our own to the course content over a semester period. The processes involved are social, political, and organizational when negotiating the curriculum, adhering to politically driven mandates, while working within the organizational structure of the school.

Dialogic Exchanges

Two full professors and their undergraduate students participated in this action research study. Thirty-six students, freshmen through seniors, enrolled in an introduction to physics class in the College of Arts and Sciences, and twenty-one senior, preservice teachers, enrolled in a secondary methods class, College of Education, participated in this electronic journaling. Students in both classes utilized the Exploring Minds Electronic Network.

Exploring Minds is an interactive electronic network that is password protected and contains provisions for teachers, researchers, and students to communicate about their class work and/or research agendas. This unique network is designed as a venue for professors, teachers, and students (middle, secondary, and postsecondary) to reflect, negotiate, and evaluate the teacher-learning process almost exclusively over the Internet (Alvarez, 1998). Exploring Minds is a self-contained system in component form that encapsulates transactions between students and learning stakeholders over the Internet interactively. Although this network contains many features, for this study, the focus was on the journal component that provided students in the respective classes to enter their thoughts, feelings, and questions following each class session that met twice a week for sixteen weeks. Students also posted reactions to their assigned class readings.[i]

Students were asked to react after each class session in their journal by carrying on a dialogue with one's self. In other words, students were to reflect on the content of the class session and express their thoughts about the facts and ideas that appealed to both their cognitive and emotional state. A rehashing of what transpired during the class session was discouraged and clearly not intended to appear in the journal other than in those instances that a specific notion or feature was referred to in the writing.

Informing Practice

After each class session and before our next meeting each of us read the journal entries that were posted by our students. Our responses to the students were predicated on the type of entry posted. For example, we were interested in the ways our students reflected upon what was being taught both in their affective and cognitive responses as well as how well they understood the facts and concepts of a specific lesson. Three levels of reflection were classified:

1) How important the facts and ideas were perceived by our students;
2) If they reported that the facts and ideas were part of their prior knowledge and/or experience; and,
3) If they applied the facts and ideas of a topic to another relevant situation.

As part of the analysis we also read each posting to determine if any misconceptions related to the lesson or reading assignment were reported in these entries.

Reviewing the responses of our students indicated that a few students maintained a continuous dialogue with us as opposed to the others who primarily maintained a running record with themselves. The majority of the postings were entries that posed either direct questions about the clarity, their understanding or specific questions, or about their interpretations of the material.

Seldom we didn't respond to a students' entry. The primary reason being that the postings were worded in such a way that "asked" either directly or indirectly for a response. Our responses took the form of answering a direct or indirect question/statement, offering encouragement, or asking to share their concerns, revelations, and/or materials with the class. Many of the postings by the students contained embedded questions that were explicitly stated or took the form of comments that were written similar to "thinking out loud." One can question the sincerity of these postings since the students knew we were reading them. However, the overall postings by the class, as a whole, together with their in class discussions indicated that their remarks were consistent with their thoughts and feelings of the course content and their interactions with us.

It was clear that students maintained a dialogue with themselves and also with us that better enabled them to understand and retain important facts and ideas. Simultaneously their electronic entries informed us of their level of understanding of each class session, and also alerted us to be more cognizant of forthcoming lessons and reading assignments so that they could be better learned and understood. Based on the students completed assignments, in class discussion, and their journal records, each of us changed the format of our course and final examination making it more applicative.

Conclusion

Electronic journaling created shared and mediating learning contexts and invited multiple connections across contextualized information. Questions, thoughts, and feelings were exchanged after students had an opportunity to reflect on each class activity and assignment through electronic journals that took place beyond the walls of the classroom. Student reflections were dependent upon how important they perceived the lesson, whether they had experienced the lesson itself in their world experience and/or knowledge of the facts and ideas being studied, and/or their ability to apply newly learned methods to other situations. Their queries informed us of any information that needed clarification or elaboration to which we could respond directly and, if warranted, make the rest of the class aware of an issue, fact, or concept that needed further explanation at our next class meeting.

This study confirmed an earlier one that concluded that it may be that when you ask students to conduct journal entries as a "dialogue with oneself" that the entries are written in such a way that evokes within the person a reflective stance that differs from when one is asked to record what transpired during the class session. This kind of posting results in a "report-like" response that is similar to a notetaking type of entry (Alvarez, 2001). This type of "report-like" entry does little to stimulate thought or evoke feelings since reflection of the class session is minimized and relegated to writing down the information and then repeating it again either from notes or memory into a journal entry.

The Exploring Minds Network facilitated teaching and learning of our course content. It also provided a means whereby meaningful learning of ideas were shared, negotiated, and continued beyond the walls of the classroom. These electronic exchanges helped us and our students negotiate the curriculum in ways that traditional lecture and college teaching does not entertain.

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NOTE:

[i] For a detailed account of the Exploring Minds Network see Alvarez, Busby, Burks, Sotoohi, and Panzarella in these proceedings.

Faculties' Reflections on Teaching Online

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Abstract: This is a qualitative ongoing case study. The main purpose of this study is to describe and analyze faculties' reflections toward an online course. Through purposive sampling techniques, six faculties in the College of Education at a large Southwest State University were selected as participants. Video-typed interviews have been conducting to explore and evaluate faculties' reflections toward online teaching in its natural environment. This study is exploratory in order to allow insights to emerge from a recursive data analysis process. The variables in the site of the research are highly complex and extensive. The research data are very dependent on context and needed to be collected in its natural environment with no controls and manipulations.

Overview of the Study

This study has been taken a grounded theory approach to allow the researchers to explore and discover the faculties' reflections toward online teaching for two reasons. First, today, different academic institutions offer teacher education graduate courses online. Therefore, online learning and faculties' reflections toward online teaching are relatively new phenomena. There is a lack of theoretical or empirical research base on this topic. Only a few researchers have focused scholarly attention on investigating or working in this field.

Finally, before entering the study, the researchers tend to analyze the research data inductively rather than to prove or disprove hypothesis. The main focus in this study is: 1) to obtain investigate, understand and the insider's views toward teaching online courses on different subject area, and 2) to expound on this study participants' perspectives and interpretations rather than researcher imposed categories.

Research Design

This study is a qualitative case study. The purpose is to investigate the faculties' reflections toward a particular phenomenon of online teaching on different subject area experiences.

Research Site

The site of the research is a large urban university at Southwest in College of Education. It is in the Fall Semester 2001. The College offers many B.A., M.A. and Ph.D. programs online.

This College was chosen to study faculties' reflections toward enhanced online teaching for three major reasons: First, today's, the most of the faculties have been strongly interested in using the web as an instructional tool to make possible communication between regular class sessions. Each week students would post their assignments and any questions, concerns, ideas online. The students could read, receive, post, exchange and/or share information on the discussion topics of each week before and after the class hour. Sometimes students would email the course professor's account directly, when they had particular questions, suggestions and /or comments any time. Second, the most of course curriculums in the College of Education have been included both computer-based learning activities into classroom and web-based learning activities, WebCT have been used for posting the students' massages and papers via electronic mail (email) and electronic bulletin board. Finally, at the future, the most of the faculties in the College of Education are considering to teach their courses totally online in the near future whereas the few of them have been delivering their courses online.

Instrumentation

This study utilized both qualitative and quantitative data to provide detailed information to the researchers for analysis. Therefore, qualitative instruments and qualitative instruments are designed due to collecting and analyzing data on the faculties' reflections toward online teaching on different subject areas. Video-typed interviews have been qualitative instruments whereas the faculty survey instrument has been a quantitative instrument in this study. Each instrument was developed and modified according to investigating the focus of this study.

Another crucial issue in this study is the validity of each research instrument. To provide the validity of these instruments in this study, the researchers have been collaborating the experts, the other faculties and the students from the other courses. These people have been asked to provide opinions regarding the following three issues: 1) readability and clarity of the questions in the faculty survey, 2) length of the instruments, and 3) other general impressions.

Data Collection

The researchers have been colleting data from different sources to investigate faculties' reflections toward teaching online. Although the qualitative case study approach has been used to obtain information on the focus of study, both qualitative and quantitative data have been collected from the research setting. Utilizing qualitative and quantitative data together in this study have been provided a more complementary and different aspects of this complex phenomenon.

Researchers have been following a careful data management process to ensure high-quality and accessible data, documentation of data collected, and associated after the study will be complete. For these reasons, the researchers regularly record and systematically store both qualitative and quantitative data into the researcher computers and videocassettes. They have been recording each collected data on the floppy diskettes and CD-ROMs every day as well as printing out each datum twice and filling them into separate folders. The researchers also regularly send all collected data into their FTP sites via WS_FTP Pro 6.02 ftp client software everyday.

The researchers have been writing short notes on these data from different sources in folders to show where related data in another can found. The researchers also index all data by using number and letters as locaters in each data being collected.

Data Analysis

This research is being operated with a qualitative case study approach. The analysis of the faculties' reflections toward online learning on the different subject areas is ongoing process, which will be started at the end of the Fall Semester-2000, through written the final report. The data analysis process in this study is analytic and recursive to inform further decisions on data being collected. It also is restructured, flexible and open to the discussions with the stakeholders and reviews of related literature.

During the data analysis procedure, the researchers briefly will followed these steps given in a logical order: 1) transcribe each video cassettes, 2) write field notes from the class and all WebCT activities, 3) identify patterns, 4) analyze the content of each class observation and the student survey, 4) work on qualitative data, 5) triangulate all qualitative and quantitative data, and report results in descriptive and narrative form.

Integrating Technology into Preservice Teacher Education: Comparing a Field-Based Model with a Traditional Approach

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Abstract: This study comprises one component of a PT3 funded investigation into the effectiveness of combining technology integration techniques with field-based preservice teacher methods courses. One data collection instrument, the Technology Attitudes and Beliefs Survey, is described. Attitude and belief differences between preservice teachers in the field-based model and those enrolled in the traditional, one-credit course are identified and discussed.

Over the past decade, rapid advancements in technology have created expanding possibilities for enhancing instruction. As a result, there remains a growing need for augmenting the instructional technology skills of both practicing and preservice teachers (Hill & Somers, 1996; Northrup & Little, 1996). Meeting those needs, however, has proven to be a struggle for many teachers (Strudler & Wetzel, 1999). Siegel (1995) reported that most K-12 teachers are generally not receiving sufficient time, access, and support to become comfortable with computers, while others have found that although some teachers have positive attitudes toward technology, many do not consider themselves competent to teach with technology (OTA, 1995; Schrum, 1999; Strudler & Wetzel, 1999).

Researchers have advocated integrating technology training throughout the preservice teacher education program (Brush, 1998). However, most teacher preparatory programs offer stand-alone technology courses. Many of those courses have curricula that fail to adequately prepare teachers for technology integration (OTA, 1995). This is especially true in states lacking specific computer competencies for teacher certification. Therefore, many preservice teachers are still entering the classroom with minimum exposure to technology and the techniques for integrating its use into instruction in real world settings (Strudler & Wetzel, 1999).

With the support of a three-year Preparing Tomorrow's Teachers to Use Technology (PT3) grant, one university is attempting to improve the way it prepares preservice teachers for technology integration. Until recently, preservice teachers enrolled in the existing program have been required to complete a one-credit, stand-alone technology course; the curriculum thus remains isolated from the environment in which it is to be applied. The primary goal of the PT3 grant shifts the focus of this experience away from skill development to means for integrating the technology with authentic teaching experiences (Brush, Igoe, Brinkerhoff, Ku, Glazewski & Smith, 2000). To achieve this, the on-campus preservice teacher course is being eliminated in favor of integrating this content into field-based courses covering instructional methods. This field-based model, also known as job-embedded learning (Loucks-Horsley, Hewson, Love, & Stiles, 1997), focuses on providing preservice teachers with authentic training experiences in real classrooms prior to their student teaching experience.

Currently, preservice teachers enrolled in the field-based program are elementary education students who follow a sequential block system in their coursework. The technology component is incorporated in the first two block semesters which cover instructional methods for teaching language arts / social studies and math / science. These courses are taught at local elementary schools where the preservice teachers are placed in K-6 classrooms. Within the technology component, each student attends workshops where he or she observes and participates in models of technology-rich lessons integrated with the given content areas. After the observation workshops, each student designs, implements and evaluates an instructional lesson for one of the content areas that effectively and appropriately utilizes technology.

The purpose of this research project focuses on collecting comparison data regarding their beliefs and attitudes related to technology integration from two groups of preservice teachers: those enrolled in the field-based model and those enrolled in the on-campus course. The data collection process is aimed at addressing the following research question: Are there differences in attitudes and perceptions toward technology integration between preservice teachers in the field-based model and those in the campus-based course?

Method

Participants

Participants were 133 preservice teachers. Of these, 24% (n=33) were completing their computer requirement on the university campus, and 76% (n=100) were participating in the field-based model. Over 90 percent were female. The majority of students (74%) were enrolled in the elementary preservice teacher education program, 11% were enrolled in the secondary education program, and 15% were enrolled in a different education program, such as English as a second language, bilingual, or special education.

Procedures

Survey data collection occurred during fall of 2001. Those preservice teachers enrolled in the field-based model completed the survey during the final class session of the technology component related to their respective methods course. Those preservice teachers enrolled in the traditional, one-credit course completed the survey during their final class session.

Materials

Materials consisted of one survey: the Technology Attitudes and Perceptions Survey. The survey was developed as a means of measuring attitudes toward technology integration as well as the degree to which the preservice teachers hold prevalent misconceptions as identified by the methods and educational technology university faculty. The survey consists of three sections: Background Information, Attitudes Toward Integration, and Environmental Resource Barriers. The Background Information section contains eight items covering such things as future teaching goal, academic year, frequency of computer use, and basic demographic information.

The Attitudes Toward Integration section includes 18 Likert-style items measuring attitudes and beliefs related to technology integration. Example items in this section include "A variety of technologies are important to enhance student learning," and "I feel that my technology course(s) has prepared me to integrate technology into my content area specialization." Participants rate all items on a four-point scale from "Strongly Agree" to "Strongly Disagree."

The final section, Environmental Resource Barriers, contains 16 items asking participants to rate their perceptions of potential technology integration barriers. Example items include "There isn't enough time in class to implement technology-based lessons," and "It is easier to use technology with smaller class sizes."

The overall Cronbach Alpha coefficient of the Technology Attitudes and Perceptions Survey is relatively high (α = 0.81), indicating it is a fairly consistent measure.

Data Analysis

Data analysis consisted of calculating means and standard deviations of scores obtained for each item on the two surveys. A one-way multivariate analysis of variance (MANOVA) was performed to determine if a significant difference in overall reported scores between preservice teachers in the field-based model and those in the campus-based course is evident. A follow up one-way analysis of variance was performed on the survey data in order to identify significant differences between the two groups on individual survey items.

Results

Table 1 displays the means and standard deviations for the five items with which the on-campus preservice teachers most strongly agreed and most strongly disagreed. The numbers represent responses on a four-point Likert scale ranging from one (Strongly Agree) to four (Strongly Disagree).

Table 1: Five items with which on-campus preservice teachers most strongly agreed and most strongly disagreed (n=33).

Statement	M	SD
Strongest Agreement:		
A variety of technologies are important to enhance student learning.	1.42	.56
A lack of knowledge about technology will impede a teacher's ability to integrate technology.	1.52	.76
In order for technology integration to be successful, teachers should have more access to computer labs.	1.64	.49
Technologies used in a lesson should be selected based on the learning goals of the lesson.	1.70	.47
It is easier to use technology with smaller class sizes.	1.79	.70
Strongest Disagreement:		
It is unreasonable to expect teachers today to integrate technology.	3.09	.84
Teaching students to use technology is **not** my job.	3.03	.92
Lower elementary students (K-2) cannot effectively use technology as a learning tool.	3.03	.95
I do **not** need more training on how to integrate technology.	2.76	.97
There isn't enough time in class to implement technology-based lessons.	2.73	.80

Note. Reponses ranged from 1 (Strongly Agree) to 4 (Strongly Disagree).

Field-based preservice teachers' responses are reported in Table 2. Means and standard deviations for the five items with which they most strongly agreed and most strongly disagreed are provided.

Table 2: Five items with which field-based preservice teachers most strongly agreed and most strongly disagreed (n=100).

Statement	M	SD
Strongest Agreement:		
It is easier to use technology with smaller class sizes.	1.55	.63
A lack of knowledge about technology will impede a teacher's ability to integrate technology.	1.57	.69
A variety of technologies are important to enhance student learning.	1.66	.62
In order for technology integration to be successful, teachers should have more access to computer labs.	1.68	.60
Technologies used in a lesson should be selected based on the learning goals of the lesson.	1.78	.69
Strongest Disagreement:		
It is unreasonable to expect teachers today to integrate technology.	3.21	.79
Teaching students to use technology is **not** my job.	3.18	.85
Lower elementary students (K-2) cannot effectively use technology as a learning tool.	2.93	.88
Technical problems can be avoided with proper teacher planning.	2.72	.81
An unsuccessful technology-integrated lesson is usually the result of lack of teacher's technical skills.	2.66	.78

Note. Reponses ranged from 1 (Strongly Agree) to 4 (Strongly Disagree).

A one-way multivariate analysis of variance (MANOVA) performed on the items revealed a significant difference among the two groups, Wilks' Λ=.60, $F(34,85) = 1.67$, p=.028. The multivariate η^2 based on Wilks' Λ was strong, .40. Results of follow-up analyses of variance (ANOVA) tests indicated that participants in the field-based experience were more likely than those in the on-campus course to disagree with the following statements: "I feel that my technology course(s) has prepared me to integrate technology into my content area specialization," $F(1,131)$=11.16, p=.001, "Technical problems can be avoided with proper teacher planning," $F(1,131)$=7.17, p=.008, and "There isn't enough time in class to implement technology-based lessons," $F(1,131)$=4.45, p=.037. Preservice teachers in the field-based models were also more likely to agree with the following statements: "Technology-integrated curriculum projects require more preparation time than projects not incorporating technology," $F(1,131)$=5.64, p=.019 and "A teacher with novice technical skills can deliver an effective lesson integrating technology," $F(1,131)$=3.99, p=.048. Table 3 includes a summary table for these items.

Table 3: ANOVA summary table.

	On Campus (n=33)		Field Based (n=100)			
Statement	M	SD	M	SD	F-ratio	p
I feel that my technology course(s) has prepared me to integrate technology into my content area specialization.	2.09	.68	2.61	.80	11.16	.001
Technical problems can be avoided with proper teacher planning.	2.27	.91	2.72	.81	7.17	.008
There isn't enough time in class to implement technology-based lessons.	2.73	.80	2.38	.83	4.45	.037
Technology-integrated curriculum projects require more preparation time than projects not incorporating technology.	2.33	.92	1.93	.82	5.64	.019
A teacher with novice technical skills can deliver an effective lesson integrating technology.	2.36	.70	2.07	.74	3.99	.048

Note. Reponses ranged from 1 (Strongly Agree) to 4 (Strongly Disagree).

Discussion

Currently, technology training is a major focus of many preservice teacher education programs. That training is provided through a variety of approaches, most of which are stand-alone technology courses. This research describes the initial comparison results of a PT3 grant designed to move technology training of preservice teachers from the university classroom to a field-based setting in which students observe lesson models integrated within their methods courses, and are expected to plan and implement a technology-integrated lesson.

Overall, results from this survey are encouraging. Both groups perceive that they are responsible for teaching students to use technology, and express agreement that a variety of technologies are important for enhancing student learning. However, both the on-campus and field-based groups also tend to disagree that a successful technology-integrated lesson is possible using one computer. They also perceive that it is easier to deliver a technology-integrated lesson in a computer lab. These generally positive attitudes regarding the importance of technology coupled with the perception that technology is easier to integrate with more computers represent an opportunity for teacher preparation programs to make an impact. Because these teachers are more likely to have 1-4 computers rather than regular access to a lab, instruction should focus on what is possible with the resources they are more likely to possess.

Results also reveal differences between preservice teachers participating in the field-based experience when compared to those enrolled in the on-campus course. Specifically, the field-based preservice teachers feel more unprepared for technology integration than their counterparts in the on-campus courses, while expressing stronger agreement with the statement that a teacher with novice technical skills is able to deliver an effective technology-rich lesson. This suggests that providing preservice teachers with a more authentic experience may result in differing perceptions regarding what a teacher needs in order to integrate technology. Preservice teachers in the field-based model, many of whom consider themselves novices, were required to plan and implement a technology-integrated lesson; therefore they are more likely to agree that it is possible for teachers to integrate technology, even if they do not have advanced skills. However, these preservice teachers also recognize a greater need for more preparation, which may result from experiencing directly what is involved with planning and implementing a technology-based lesson.

In addition, those participants in the field-based model were more apt to recognize that planning for technology-integrated lessons requires more time, and their responses showed stronger agreement that there is not enough time to implement technology-based lessons. This reflects a more accurate perception of the time that is involved in planning and implementing technology-rich lessons. During the initial data-gathering phase of this PT3 grant, methods and educational technology faculty expressed that the preservice teachers who participated in the traditional model of instruction held an unrealistic perception of the time involved in technology integration (Glazewski, Brush, & Ku, 2000). It is encouraging to see that those experiencing the field-based model hold a more accurate perception of time.

The limitations of this study, however, should not be overlooked. The small number of participants enrolled in the on-campus course who completed the survey may not adequately reflect the attitudes and perceptions of this group as a whole. For this reason, further research should attempt to obtain a larger sample. Doing so should increase the power associated with the statistical results, and, thus, account for a larger percentage of variance related to technology attitudes and perceptions.

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The Student Voice: Results of an Attitudinal Survey

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Abstract: This paper presents specific findings based on a three-year campus-wide student attitude survey of web-delivered learning. Since 1998, the University of Indianapolis has utilized Blackboard to augment and web-deliver courses. The survey collects demographic data and several attitudinal questions scored on a 5-point Likert scale. Additional open-ended questions are included. The survey consists of a web-based form administered anonymously institution-wide in all courses that have integrated the web into teaching and learning. Findings indicate that as time passed, students perceived their computer skills were more sufficient and that their computers were more adequate for the course requirements. Data indicate a negative correlation with the term in which the course was taken chronologically and instructor-student interaction, course pace, learned more, and required more time. Correlations among the data provide information for developing a useful distance learning attitude survey.

Introduction

The University of Indianapolis is an independent, comprehensive university affiliated with the United Methodist Church. Approximately 1,900 undergraduate day division, 900 graduate and 1,200 non-traditional students pursue credit in undergraduate, graduate, and continuing education programs.

The presenters have analyzed data collected from a student survey based on three years of institution-wide web-enhanced, web-based and distance learning courses using Blackboard. The online survey consists of demographic data and several attitudinal questions scored on a five point Likert-type scale (see end of paper). Additionally, open-ended questions are provided to the students. Anonymous responses are used to improve course offerings in the web-learning environment at the university. Implications of the data analysis reveal valuable information for colleges whose faculty and administrators have concerns about changing the traditional university interaction of faculty and students in a classroom.

The university utilizes Blackboard to support three types of web instruction: those using the web to augment instruction (web-enhanced), courses that have significantly reduced seat time (web-based) and courses delivered entirely via the web (distance learning). For the purposes of this paper, data have been aggregated by term. Further data analysis will be presented in the session.

Scope of Research

A total of 1410 students responded to the survey over the three-year period. Table 1 shows the breakdown of the respondents by semester. As indicated in Table 2, the number of male respondents was approximately 30%, and the number of female respondents was approximately 70%. This is representative of the university demographics. As indicated in Table 3, approximately 45% of the respondents were under the age of 20. Moreover, almost 85% of the respondents are under the age of 30. Less than 7.8% of the respondents were over the age of 41.

Term	Number of Respondents
Semester II, 1998-99	104
Semester I, 1999-2000	392
Semester II, 1999-2000	458
Semester I, 2000-2001	291
Semester II, 2000-2001	165
Total	1410

Table 1: Number of Respondents by Term

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	419	29.7	30.2	30.2
Female	970	68.8	69.8	100.0
Missing	21	1.5		
Total	1410	100		

Table 2: Gender

Age	Frequency	Percent	Valid Percent	Cumulative Percent
Under 20	63.5	45.0	45.8	45.8
21-30	536	38.0	38.6	84.4
31-40	108	7.7	7.8	92.2
41-50	80	5.7	5.8	98.0
Over 50	28	2.0	2.0	100.00
Missing	23	1.6		
Total	1410	100.0		

Table 3: Age

When asked if they understood the computer requirements before enrolling in the course, approximately 50% of the students agreed or strongly agreed. Approximately 30% of the respondents did not understand the computer requirements upon enrolling in the course. A large portion of the 30% occurred in the first year of offering the course in the web-based format during which the web-based requirement was not indicated in the schedule and the students were not informed of the format of the course when registering. As indicated in Table-4, understanding computer requirements is positively correlated with the term for the course; hence the students understand computer requirements more now than when the university first employed web-based learning. One reason for the correlation between understanding computer requirements and the term could be due to the following reasons: the web-based format was listed on the schedule after the first year and informal communication amongst students increased.

The next two variables addressed whether students had a sufficient computer and whether they had sufficient computer skills when enrolled in the course. Eighty-nine percent of the students reported to have use of a computer that was sufficient to meet the course requirements; however, almost 7% of the students did not have a computer or it was not sufficient for the course. Not only is the computer sufficiency variable important, it is essential to analyzing whether the students had the computer skills to take a web-based course. Over 90% of the students agree or strongly agree that their computer skills were sufficient for this course. Conversely, only 4% of the students did not feel that their computer skills were sufficient for this type of course. As indicated in Table-4, understanding computer requirements, having sufficient computer skills and having a sufficient computer are positively correlated with the term for the course, thus the longer the university employed courses in this format the more likely the students were to agree or strongly agree that they understood the requirements, their computer was sufficient and they had sufficient computer skills.

Besides computer variables, interaction variables (instructor available, sufficient instructor interaction, and sufficient student interaction) must be addressed. As in all courses, it is imperative to determine the student's perception of the instructor availability. Less than 8% of the students did not feel that the instructor was available to provide assistance. When evaluating the interaction, it is imperative to evaluate the student-to-student interaction and the student-to-faculty interaction. Eighty percent of the students reported the interaction with the instructor was sufficient. On the contrary, 9% of the students did not feel that the interaction with the instructor was sufficient. Sufficient instructor interaction was negatively correlated with the term; hence, students perceived that the instructor interaction was much greater when the web-based courses were first offered. The expectations and the numerous course offerings of courses in this type of format could be the reason for the negative correlation. The majority, 75%, of the students enrolled in this course believed that the student-to-student interaction was sufficient, however 7% of the students did not feel that the interaction with other students was sufficient.

In addition to computer and interaction variables, course variables were analyzed. The course variables analyzed in this paper are appropriate pace, appropriate delivery approach, organized material, learned more, required more time, enroll in more, and recommend this type of course.

Over 77% of the students reported the pace of the course was appropriate; however, 11% of the students did not feel that the pace of the course was appropriate. The course pace was negatively correlated with the term; hence the students reported that the course pace was not as appropriate as it was when the web-based course was fist offered. The change in technology and expectations could be reasons for these results.

Over 70% of the students enrolled in the course reported the delivery approach was appropriate. On the other hand, 10% of the students did not believe that the delivery approach was appropriate. Moreover, the majority of the students, 75%, believed that the course material was well organized. The key questions, "Did you learn more than a traditional course?", "Would you be interested in enrolling in more courses offered via this technology?", and "Would you recommend other courses delivered via the same technology?", were also analyzed. Over 44% of the students reported that they learned more in this course than a traditional course. Moreover, 43% of the students reported they spent more time in this course than a traditional course. However, the number of students reporting that they learned more and the courses required more time have declined over the three years, hence the negative correlation between term and these variables. The expectations and the numerous course offerings of courses in this type of format could be the reason for the negative correlation. The majority, 68% of the students reported they would be interested in taking another course in this type of format. As indicated in Table–4, there is a positive correlation between term and enrolling in more courses; hence, the students are more likely to enroll in web-based format courses now than three years ago. Finally, over 70% of the students reported they would recommend this type of format.

	CR	SC	CS	IA	II	SI	PA	LM	MT	DA	OR	EM	RE
TE	**	**	**	NS	n*	NS	n*	n*	n**	NS	NS	**	NS

NS indicates no significance

n indicates a negative correlation

* indicates a positive correlation at the .05 level

** indicates a positive correlation at the .01 level

Table 4: Correlation with Term

List of Variables:

CR = Understood Computer Requirements
SC = Sufficient Computer
CS = Sufficient Computer Skills
IA = Instructor Available
II = Sufficient Instructor Interaction
SI = Sufficient Student Interaction
PA = Appropriate Pace
LM = Learned More than a Traditional Class
MT = Required More Time than a Traditional Class
DA = Appropriate Delivery Approach
OR = Course Material Organized
EM = Enroll in More
RE = Recommend this type of course
TE = Term, Year of course

The majority of the students agreed or strongly agreed that they understood the computer requirements, their computer and computer skills were sufficient. Moreover, the majority of the students agreed or strongly agreed that interaction was sufficient; however, there is a negative correlation between instructors to student interaction. The majority of students agreed or strongly agreed that the course pace was appropriate, the delivery approach was appropriate, and the course material was organized. However, course pace was negatively correlated with the term. The majority of the students reported that they spent more time and learned more than a traditional class; however, there is a significant decline in students reported this over time. Finally, students would enroll in more courses in this format and they would recommend web-based courses to others

Recommendations:

Data analysis indicates that the survey items contained useful information. The exceptions are the items "On average, how much time did you spend in a week accessing course materials?" and "On average, how much time do you spend per week with a traditional course?" Student responses were vague and of little meaning. More data need to be collected to determine why there is negative correlation with the term and instructor-student interaction, course pace, learned more, and required more time. Otherwise the only survey additions we plan to make in the future will assist in collection of more specific demographic data such as department and school in which the course is offered, student's major, and full-time or part-time student. We also plan to add items asking each instructor what technologies they are using with their courses in addition to Blackboard. These may affect student responses to items relating to technology.

Distance Learning Assessment

Bio/Demo Information:

What is your gender?

❑ Male ❑ Female

What is your age?

❑ Under 20 ❑ 21-30 ❑ 31-40 ❑ 41-50 ❑ Over 50

Country of residence? (International students, please provide your country): *(fill-in the blank)*

Computer-related Questions:

Which computer did you use most frequently?

❑ Macintosh ❑ Windows 95/NT ❑ Windows 3.1

Which Web browser did you use most often?

❑ Netscape 4.0 or later ❑ older version of Netscape ❑ I don't know
❑ Internet Explorer 4.0 or later ❑ older version of Internet Explorer

How did you most often access course materials?

❑ University computer lab or residence hall ❑ Direct dial-in to university
❑ IndyNet ❑ Other Internet Service Provider (AOL, GTE, etc.)

What is the speed of your modem?

❑ 28.8K ❑ 33.6 K ❑ 56 K A direct connection ❑ I don't know

How much memory is installed on your computer?

❑ Less than 16MB ❑ 16MB ❑ 32MB ❑ 64MB or greater ❑ I don't know

Likert Scale:

1 –Strongly Agree	**2 –Agree**	**3 – Undecided**
4 – Disagree	**5 – Strongly Disagree**	**6 – N/A**

I understood course requirements before I enrolled: 1 2 3 4 5 6
My computer was sufficient to access the course materials: 1 2 3 4 5 6
My computer skills were sufficient for this course: 1 2 3 4 5 6

Technical Issues:
I did not encounter any technical problems when I tried to access course materials: 1 2 3 4 5 6

If any, what types of technical problems did you encounter while trying to access course materials? Please give error messages if you recall them. *(Short answer)*

Course Information:

Course being evaluated: *Student selects course from a drop-down menu*
In which term are you enrolled? *Student selects term from a drop-down menu*

What is the level of the course?
❑ Undergraduate ❑ Graduate ❑ Continuing Education

The course briefing/orientation (if you received one) explaining how to use the software was helpful in making the most of the course: 1 2 3 4 5 6
The instructor was available to provide assistance: 1 2 3 4 5 6
My interaction with the instructor was sufficient: 1 2 3 4 5 6
My interaction with other students was sufficient: 1 2 3 4 5 6
The pace at which the course progressed was appropriate: 1 2 3 4 5 6
I learned more in this course than in a traditional course: 1 2 3 4 5 6
The course required more time than a traditional course: 1 2 3 4 5 6
The delivery method used in this course was appropriate: 1 2 3 4 5 6
Course materials were well organized: 1 2 3 4 5 6
I would be interested in enrolling in more courses offered via this technology: 1 2 3 4 5 6
I would recommend other courses delivered via the same technology: 1 2 3 4 5 6
Was your Internet access to the course adequate? Please explain: *(short answer question)*
What are the strengths of offering a course via this technology? *(short answer question)*
What are the weaknesses of offering a course via this technology? *(short answer question)*
What would you change about how this course was taught? *(short answer question)*
On average, how much time did you spend in a week accessing course materials? *(short answer)*
On average, how much time do you spend per week with a traditional course? *(short answer question)*
Please list any additional comments you may have: *(short answer)*

Optimizing informal learning experiences in the home and school

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Abstract: This paper describes an array of research projects that explore the use of ICT within the home and other informal settings to enhance motivation, learning outcomes and contribute to the attainment of children in school.

It is important for teachers, researches and policy makers to be more aware of the ways children are using computers in the home. New evidence from longitudinal research projects in the UK suggests that effective integration of ICT within the school environment is constrained by: -

- an underestimate of children's experience and facility with ICT
- a lack of appreciation of the power of collaborative environmental environments made possible by ICT
- a narrow conception of knowledge and its construction
- lack of time and opportunity for teachers to explore the Internet and engage in purposeful but playful activities that contribute to confidence and vision.

This paper reports on the findings of major longitudinal studies commissioned by the UK Government. The impact of informal learning on pupil attainment at school will be discussed in the light of important issues identified as subjects for current and future research.

There is untapped potential in greater home-school linkage and collaboration. The wider learning environment in which children can flourish needs to be understood more fully. In the UK research projects are currently exploring the possibilities of raising pupil attainment through new forms of home school collaboration. Such research recognises the undervalued knowledge and skills of parents, peers, extended family and global www communities.

Recent longitudinal studies have found that the ways children learn to use computers at home are markedly different from the ways they use them at school. Alongside a huge investment of UK Government funding in the National Grid for Learning (NGfL), new technologies are being adopted very rapidly in a majority of homes. Schools are currently coping with children who have an increasingly broad range of computer skills and very high expectations of ICT.

Traditional approaches to schooling may not optimize the exciting possibilities offered by ICT such as the development of higher level conceptualization, better problem solving, more complex collaborative learning in small groups. The British Educational Communications & Technology Agency (Becta) is engaged in several research projects to seek reliable measures for identifying and documenting the impact of home based informal learning activities in relation to attainment in school.

Becta is managing the largest and most comprehensive national study of the impact of ICT on the attainment of pupils from 1999-2002. This study, known as ImpaCT2, involves 60 schools in England and over 2000 pupils. The researchers indicated in their early finding that exposure to networked technologies may impact on learning in ways that are not reflected in formal tests of attainment in Mathematics, Science and Literacy. Nevertheless the skills and attitudes acquired in informal settings may well be essential to developing effective learning strategies.

ImpaCT2 has five specific aims to:

- identify the impact of networked technologies on the school and out of school environment
- determine whether or not this impact affects the educational attainment of pupils aged 8-16 years
- provide information that will assist in the formation of national, local and school policies on the deployment of ICT

To do this the researchers

- devised innovative new methods of assessing pupil attainment and
- devised a framework for measuring the ICT environment.

The ImpaCT2 study makes the assumption that there are new empirical and conceptual challenges involved in attempting to identify a causal relationship between children's use of ICT and improvements in their attainment. The findings show widespread use of ICT across all school age children, with those who use computers at home tending to use them more frequently and confidently at school:

- 80% of UK school pupils now have a computer at home
- primary school children (aged 8-11 years) spent three times longer on ICT at home compared with school and secondary pupils (aged 11-16 years) spent four times longer.
- 52% of primary and 67% of secondary pupils had e-mail addresses
- 14% of primary and 67% of secondary pupils had created their own web page

The research suggests that schools with greater ICT resources may provide more opportunities for children to create web pages, encourage children to have an e-mail address and may have a positive influence in persuading parents to buy a home computer.

Although many children and young people are positive about using computers in the home, many are disillusioned with school ICT. Often they find the restrictions on Internet access frustrating and the speed of individual PCs or networks are less efficient than they experience in the home. Although it is recognised that important forms of learning takes place both in homes and classrooms, teachers and parents and children rarely have the opportunity to share, discuss and use their experiences and skills.

There are some important differences emerging in the ways in which adults and children experience this new technology. When children and young people use the computer for pleasure they learn by playful discovery and experimentation. They ask family, friends and use electronic help frequently such as chat rooms and web sites. Their use of computers at home tends not to include educational software but they do choose to write, design and play games (often in group situations on or offline).

Teachers are increasingly being asked to develop innovative ways of teaching with ICT. In particular they are asked to use the Web to develop new ways of communicating with parents, children and colleagues.
There is a growing concern that teachers have little time to integrate ICT meaningfully into the school curriculum and ironically they feel that pressure of work prevents them for 'surfing' and exploring the www. Their experience of learning via the web is thus very different from that of children who tend to find serendipitous links and spend a lot of time discovering interesting resources and passing on links to friends.

Many schools are utilizing ICT by integrating it into subject teaching, and an increasing number are encouraging pupils to carry out internet-based research out of school. Schools are also using the Internet and e-mail to make global links within class time. There is a growing challenge for teachers who are then asked to mark computer produced homework. They are also facing the consequences of differential access in the home which can make it difficult to know how best to compensate for the digital divide within the school environment

Previous research has strongly indicated the beneficial outcomes of using ICT in education. Factors such as learner engagement, enhanced enjoyment, increased commitment to the task; increased autonomy and self-esteem are frequently mentioned (Cox 1997, Someck 1996, Bonnet et al 1999, Davies & Somekh 1997 and Cole 2000). However there is a complex web of social, cultural and economic factors impacting on educational standards and attainment. This makes it very difficult to isolate or extrapolate the direct effects of ICT on teaching and learning.

The ImpaCT2 study has so far found a strong relationship between access to computers and the Internet at home and socio-economic status. The high cost of UK Internet access and software packages means children in less affluent homes are prevented from using information technology to its fullest potential, while those in wealthier families are able to enhance their learning with a treasure trove of online information at their fingertips.

Both children and teachers took part in this research, which used innovative methods of data collection. Sixty schools took part in the research and in each a *teacher researcher* was given a laptop computer to help them record and communicate data. In each school pupils carried out independent research by keeping weekly logs of ICT usage and interviewing fellow pupils. Pupil questionnaires were used to collect data on ICT activity at home and school, and concept mapping was used to gain insights into children's ideas about how they visualize the current use and future potential of networked computers.

Instructional Design Strategies for Summer Online Courses

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Abstract: One may think that a summer online course is just a condensed version of a regular semester online course. If the instructor squeezes an 18-week semester of course material into a 6-week time frame, and the students triple their time and efforts studying online, then the outcomes of learning should be the same. In fact, due to the nature of online learning, different instructional strategies should be used for the design and delivery of short- and long-term online courses in order to maintain the quality of learning without reducing the amount of instruction. A combination of objectivist and constructivist instructional methods was used for the design of a short-term summer online course. It yielded positive results.

With the rapid growth of technology and the wide spread concept of life long learning, academic institutions are rushing headlong into the distance education arena and are offering a variety of online courses not only during regular semesters but also during summer sessions. One may think that a summer online course is just a condensed version of a regular online semester course. It works the same way as face-to-face classroom instruction. If the instructor squeezes an 18-week semester of course material into a 6-week time frame and the students triple their time and efforts studying online, the results of learning should be the same. In fact, due to the nature of online activities, usually both teachers and students invest much more time on online learning tasks compared to the same course taught in a traditional classroom. Besides the time factor, long-term and short-term online courses work very differently in many ways; consequently, different instructional strategies should be used for the design and delivery of summer online courses in order to maintain the quality of learning without reducing the amount of instruction.

The positive value of employing constructivist learning theories in the design of online learning environments and activities has been supported by the educational literature (Hannafin, Land, & Oliver, 1999; Palloff & Pratt, 1999, 2001). Recently, with the move of constructivism into education, there is a growing interest among teachers and instructional designers in adopting constructivist philosophy of teaching and learning in the design and delivery of their online courses. However, constructivist-based learning activities require more time and effort from both the instructor and the students. There will be no problem if a constructivist-based online course is offered during the regular semester. Students have sufficient time to work collaboratively with their peer learners to construct knowledge or to solve assigned problems through authentic learning activities. However, it would be a challenge for the instructor to implement the same instructional method in a summer online course given that he/she only has one-third of the regular semester hours to cover the same amount of course material and to achieve the same objectives.

The effects of traditional objectivist instructional design theories derived from behaviorism and cognitive psychology have long been acknowledged and commonly used by educators in various learning environments. The objectivist instructional design models advocate systematic planning of instructional materials and learning activities so that students can follow through the prescribed steps to obtain the desired learning outcomes. This school of theories grants to instructors the control of learning such as environment, materials, students, activities, and time. Efficiency and predictability are some of the strengths of objectivist-based instruction.

If time is the essential factor affecting the success of short summer online courses, instructional designers may consider using a hybrid approach for the design of the summer online course, which combines the strengths of objectivist and constructivist methods of teaching and learning. The intention of this paper is to share my experiences of designing and teaching long- and short-term online courses in the past year.

A short 6-week summer online course was designed based on the constructivist learning environment design model suggested by Jonassen (1999). The course was offered during the summer I session. The result of implementation was far from expected due to insufficient time for communication and collaboration, which are essential for constructivist learning. A decision was made to employ both objectivist and constructivist instructional methods in the revision of the course, which was offered again during the summer II session. The revision included:

Course orientation –

. Instead of asking the students to go through the entire tutorial in order to learn how to use the course management system to take the course, selecting only those tools that would be used in the class.

. Developing a step-by-step job aid.

. Including the job aid in the course resources.

. Integrating a practice of these tools into the course orientation activities and made the practice as an assignment prior to the start of the course. For example, asking the students to post an introduction of themselves to the forum, send an e-mail about their expectations of the course to the instructor, upload their digital picture to the online folder, etc.)

Instructional design of the units – The course contained four units.

. Selecting a unit pertaining to the potential for problem-based learning, but the level of difficulty and complexity of the problem was manageable and accomplishable within a 2-week time frame to be the group project, and using constructivist approach to design this unit.

. Applying objectivist instructional design principles to design the rest of the three units.

. Prescribing detailed instructions on content, class activities, and assignments.

. Providing detailed assignment procedures, rubrics, and criteria for grading.

. "Clarity" was the key for designing the units using the objectivist approach.

Class activities or learning community -

Although the objectivist approach was employed in the design of the majority of the units, most learning activities were designed based on the constructivist learning theories. A big learning community involved the entire class members and four sub-communities consisted of only the members of the groups were formed. Students were advised to work collaboratively not only on the group project but also on the individual projects. The goal of collaboration was for the students to assist each other in obtaining a better quality product. Students were also made aware that their contribution to the teamwork would be graded.

The revised course was well received and highly rated on the students' evaluation at the end of the class. On the exit reflection, most students indicated the following as the most helpful features of the course: clear instructions on how to use the tools to take the course, the assignment criteria and rubrics, quick response from the instructor, and the in-time feedback on draft assignments from the instructor and the classmates. In conclusion, a short summer course, in order to be effective, should employ a combination of objectivist and constructivist instructional design approaches.

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Advancing Teachers Through Stages of Adoption of Technology in the Classroom

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Abstract: Stages of Adoption of Technology are used in conjunction with other assessment instruments to determine attitude, skill and technology access changes that assist in moving a teacher further along in his/her level of classroom technology integration. Prototypical characteristics are used to formulate strategies for professional development in advancing teachers toward higher stages of adoption. This paper summarizes characteristics at each stage of adoption and address issues faced in promoting transitions from one stage to the next. Example strategies that could foster transitions are also provided.

Introduction

Stages of Adoption (Christensen, 1997) is a self-assessment instrument of a teacher's level of adoption of technology, based on earlier work by Russell (1995). There are six possible stages in which educators rate themselves: Stage 1 - Awareness, Stage 2 - Learning the process, Stage 3 - Understanding and application of the process, Stage 4 - Familiarity and confidence, Stage 5 - Adaptation to other contexts, and Stage 6 - Creative application to new contexts. These six stages form an ordered continuum that has been shown to function as a reasonable interval-level measurement scale (Knezek & Christensen, 1999).

Teacher attitudes can be differentiated according to levels that characterize each stage of adoption. Instruments used for skill and attitude assessment are described in the following section.

Attitude/Skill Measurement Scales

Several information technology attitude instruments were developed and validated by the authors during 1995-98. One of these instruments, plus a second authored by Ropp (1999) with a focus on technology proficiency, form the core of the stage classification data presented in this paper. Each instrument used in this study is briefly described in the following paragraphs. More detailed information is available in the book *Instruments for Assessing Educator Progress in Technology Integration* (Knezek, Christensen, Miyashita, & Ropp, 2000).

The Teachers' Attitudes Toward Computers Questionnaire (TAC) (Christensen & Knezek, 1998) measures seven major indices regarding teacher attitudes. These scales are: 1) Enthusiasm/ Enjoyment, 2) Anxiety, 3) Avoidance/Acceptance, 4) E-mail for Classroom Learning, 5) Negative Impact on Society, 6) Productivity, and 7) Semantic Perception of Computers. Internal consistency reliabilities for these scales typically range from .87 to .95 with K-12 teacher data (Christensen & Knezek, 2001).

The Technology Proficiency Self-Assessment Instrument (TPSA) was included to gather data on teacher competencies (Ropp, 1999). This instrument was selected because it has good reliability and measures skills recommended by the International Society for Technology in Education (ISTE) for all K-12 teachers. Four of

Ropp's measurement scales (with five items each) were included: Email, Integrated Applications (IA), Teaching with Technology (TT), and the World Wide Web (WWW). Respondents rate their skills on a scale of 1 (strongly disagree) to 5 (strongly agree). Reliabilities for these four scales ranged from .78 to .88 for K-12 teacher data gathered from 417 respondents in Texas during 1999.

Study 1: Relationship of Attitudes to Stages of Adoption

In an initial study conducted using the Stages of Adoption instrument in 1998, the average Stage of Adoption value across a sample of 1,135 educators was 4.13, with educator representation falling in each of the six stage categories (see Fig. 1). High correlations were found between stages of adoption and computer anxiety ($r = .67$, $p < .0005$, $N = 973$), in the direction of higher stages being associated with reduced anxiety. Higher stages of adoption were also strongly associated with increased computer enjoyment ($r = .60$, $p < .0005$, $N = 973$). Background information was gathered regarding home access to computers and the Internet. To determine whether use of a computer at home or access to the WWW at home made a difference in a teachers' stage of adoption, t-tests were carried out. Findings were that both home use of a computer and home access to the Internet were very strong discriminators for high or low stages of adoption (Knezek & Christensen, 1999). The nature of the relationship appears to be that home access makes a large contribution to technology integration advancement at the higher stages.

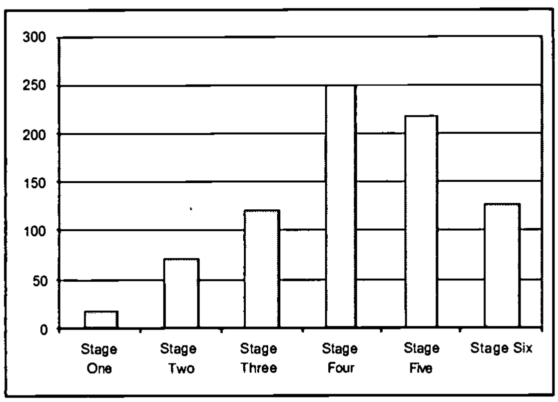

Figure 1. Distribution for stages of adoption of rural Texas educators, 1998.

Stage One Teachers

As shown in Tab. 1 and Fig. 2, teachers who were in Stage One (awareness) rated themselves lowest (among those in the six stages) in computer enjoyment, computer avoidance, Email, productivity and overall perception of computers. They rated themselves as being more anxious toward computers and more negative in their feelings about the impact of computers.

Factor	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
F1 – Enjoyment	2.97	3.15	3.39	3.62	3.85	4.12
F2 – Anxiety	2.59	2.67	3.22	3.58	4.01	4.44
F3 - Avoidance	3.36	3.62	3.79	3.93	4.08	4.28
F4 - Email	3.14	3.08	3.13	3.23	3.30	3.62
F5 – Negative Impact	3.13	3.11	3.40	3.62	3.70	3.96
F6 – Productivity	2.88	2.98	3.10	3.28	3.39	3.62
F7 – Semantic Perception	4.58	4.55	5.02	5.44	5.77	6.13

Table 1. Attitude factors by stage of adoption of technology for 1141 rural Texas teachers, 1998

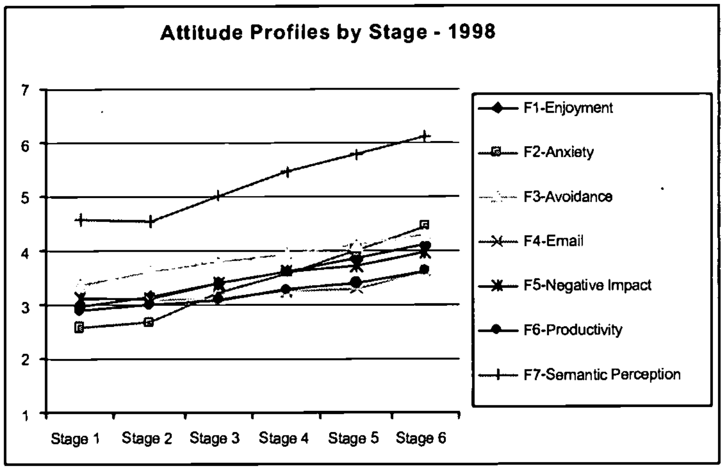

Figure 2. Teacher attitude profiles by stage for rural Texas educators, 1998

Stage Six Teachers

Teachers who reported being in the sixth stage of technology adoption had the highest mean scores among the six stages of adoption category groupings in computer enjoyment, Email, productivity, and semantic perception of computers. This subset of teachers also rated themselves the lowest of all the groups of teachers in anxiety, computer avoidance, and a negative feeling toward the impact of computers.

Study 2: Attitudes by Stage and Home Access

In spring 2000, data were gathered from 344 teachers in a west Texas urban school district near the international border with Mexico. As shown in Fig. 3 attitude profiles by stages were similar to those previously reported for the 1998 rural sample.

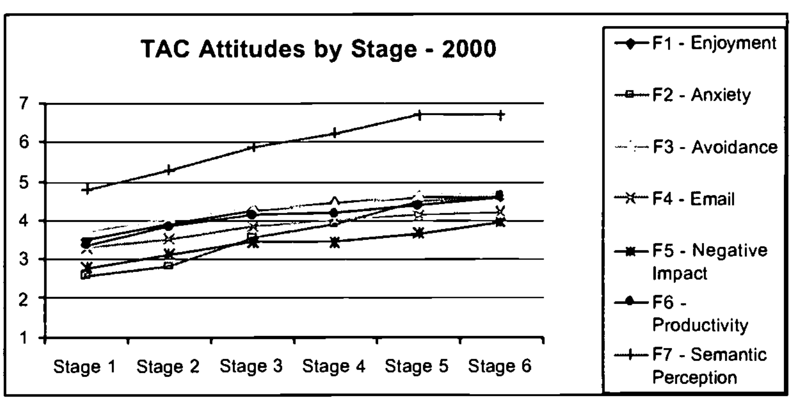

Figure 3. Teacher attitude profiles by stage for urban Texas educators, 2000

Influence of Home Access

In a 2001 study in the same urban district with a sample of 117 teachers, almost 85% reported having access to a computer at home while only 57% reported having access to the Internet at home. Tab. 2 and Fig. 4 show the near linear relationship between stages and computer access at home.

Stage	No Home Comp	Home Comp
Stage 1	0	0
Stage 2	3	6
Stage 3	6	13
Stage 4	3	21
Stage 5	3	25
Stage 6	1	31

Table 2. Stages of technology integration by home computer access, Laredo teachers 2001

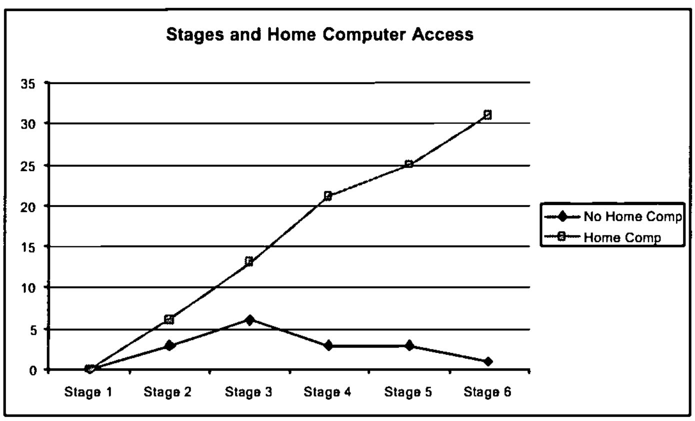

Figure 4. Stages of adoption and home computer access

This same sample of teachers also reported the frequency in which they used computers for student learning activities in their classrooms. As shown in Tab. 3 and Fig. 4 it is the teachers at the highest stages who use computers more frequently with their students for learning activities.

Stage	Never	Occasionally	Weekly	Daily
Stage 1	0	0	0	0
Stage 2	0	3	3	3
Stage 3	2	7	5	5
Stage 4	1	10	4	8
Stage 5	0	9	6	11
Stage 6	1	6	7	18

Table 3. Teacher-reported frequency of computers for student learning activities, Laredo 2001

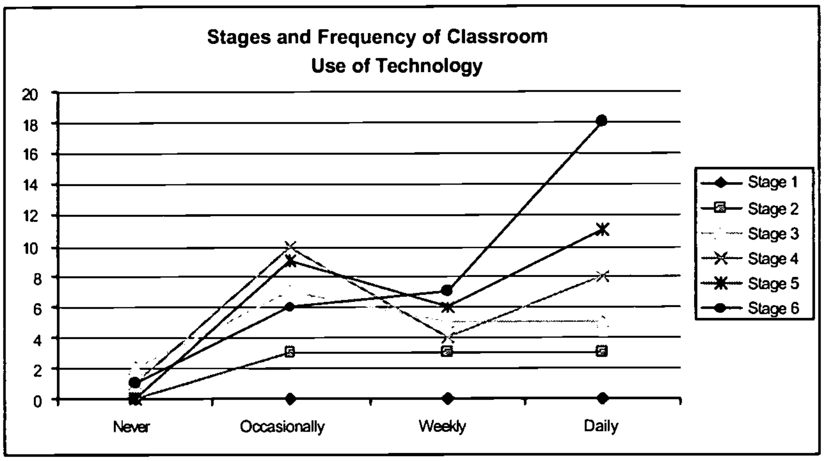

Figure 5. Stages and frequency of classroom use of technology

Discussion

As shown in Fig. 3, many Stage One and Stage Two teachers appear to have high levels of anxiety toward computers (F2). However when teachers reach Stage Three they begin to become less anxious and continue to become less anxious progressively throughout Stages Four, Five, and Six. Teacher education might focus on these Stage One and Stage Two teachers to reduce their anxiety by educating teachers in something that will apply immediately and then move on to classroom integration after they lower their anxiety and gain confidence in using technology.

Profiles of characteristics of educators in various stages of adoption allow the formulation of strategies for promoting advancement to the next higher stage. The concepts of will (attitudes), skill (competencies) and information technology tool access are conjectured to be essential parameters determining whether or not smooth transitions occur from stage to stage. However, simultaneous improvement in all three areas may not be necessary. These findings have ramifications for decision makers seeking to plan the most efficient and productive professional development growth path for technology-using educators.

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Teaching Technology Infusion to In-Service Teachers: A Case Study

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Abstract

As school administrators increasingly see the importance of teachers using technology, there is a demand for technology related professional development for in-service teachers. As an on-going evaluation of a federally funded technology innovation grant, the researchers conducted a case study of a week long summer training session for teachers involved in the grant. The goal of the workshop was to help teachers integrate technology into their own curriculum plans. This study was designed to examine the development of relationships between the teachers and the trainers.

The researchers found characteristics of trainers associated with more teacher involvement and interest in technology use. Trainers who view themselves as learners and understand the difficulties of learning technology skills are more productive with teachers. On the other hand, trainers who present themselves as experts on technology often develop negative working relationships with teachers. This case study provides practical implications for successful professional development.

Introduction

There is an ever-increasing demand for more effective ways to deliver instruction in the classroom. Technology use is an avenue that many education professionals are exploring to address this demand. To promote the enhancement of delivery of instruction in middle school classrooms in four schools in Mississippi's second congressional district, the CREATE for Mississippi project was implemented. A federally funded project, CREATE for Mississippi, is a technology innovation grant originally intended as a five-year grant that is being funded on a yearly basis. The project's main goal is to support the educational technology initiative in the state of Mississippi. CREATE addresses four main areas that have been identified in the literature as barriers of technology infusion instruction. These barriers are lack of time, training, equipment, and support. The barriers of lack of training and support are addressed in the 2001 Summer Training Session of new CREATE core teachers.

In the summer of 2001, the second year of the project, a group of teachers from the Congressional District 2 (CD2) of Mississippi attended a workshop for a week on the campus of Mississippi State University as part of their obligation as core teachers or as educational technologists. The new CREATE core teachers were a group of 16 teachers from the Delta area of Mississippi. These teachers are mostly veteran educators in economically challenged school districts. The summer training session aided the teachers in improving their method of instructional delivery through technology integration. Four teachers and one ET from three of the four schools from CD2 involved in this project participated in the workshop. Only three teachers from one of the schools were at the workshop.

The goal of the workshop, as well as the CREATE for Mississippi project, was to help teachers integrate technology into their own curriculum plans. The training available at this training session was provided through the CREATE staff and teachers and an ET from CD1. The barrier of lack of support is addressed by the presence of the CREATE staff and core participants from CD1 who will serve as mentors during the 2001-2002 school year. The workshop trainers focused on teaching the teachers basic computer skills while assisting them to create lesson plans infused with technology. Throughout the year, each teacher will be expected to create at least three more technology-infused lesson plans to be published on the CREATE website (www.create4ms.org) in conjunction with using technology in their teaching. The goal is that these teachers will become comfortable enough with technology to mentor other teachers in their schools to use technology in their teaching plans as well. The interactions and relationships developed among the teachers from the four core schools and between the new core teachers and training staff will be explored in this paper.

CREATE for Mississippi

CREATE is an acronym for Challenging Regional Educators to Advance Technology in Education. CREATE for Mississippi is a federally funded Technology Innovation Challenge Grant (TIGC) that is presently in operation in three congressional districts in the state of Mississippi. The major thrust of the CREATE project is to provide training and support for participating schools in order to advance their technological capabilities.

Four core subject area teachers were chosen by the school administrator at each school. The four core teachers will receive on going training on technology equipment and software. The core teachers are responsible for mentoring other teachers in the school and for developing lesson plans to be submitted to the CREATE staff. The core teachers are allotted one hour a day to work on technology integration. This one hour is designed for the teacher to find useful websites, write lesson plans, work with the ET, or perform any other task that is related to their growth in technology,

The CREATE project includes a component that addresses technology availability in the school. Through the project the core teachers have access to technology equipment designed to enhance classroom instruction. Teachers are provided with a technology support cart with components such as: (a) computer, (b) wireless keyboard, (c) scanner, (d) digital camera, (e) flex camera, (f) video editing hardware, and (g) digital video camera. The teachers also have access to a fifteen-unit wireless laptop cart in addition to a laptop strictly for teacher use.

Another component of the CREATE project is the support provided to the core teachers. This support is provided through the availability of the Educational Technologist (ET). The ET is responsible for providing teachers with technology training and just- in-time support. The ET serves as a liaison between the teachers and the unfamiliar technological grounds that they may tread. The ET is also responsible for the development of the student technology team.

The student technology team is monitored and trained by the ET. The student technology team is responsible for correcting problems that the teachers may encounter while infusing technology in lesson delivery or planning. The technology team is also available to train teachers and to be trained on new software that is available. The ET provides professional development sessions for the core teachers in the school as well as the non-participating teachers.

2001 Summer Training Session

During the week of June 11-15, 2001, 15 core teacher and 3 ET's from 4 schools in CD2 received technology training at Mississippi State University. The training sessions were conducted by the staff of CREATE for Mississippi as well as teachers and an ET from CD1. The teachers attended sessions on the use of Microsoft PowerPoint, Microsoft Excel, Microsoft Word, digital cameras, scanners, printers, and laptop computers. The sessions were eight hour sessions during the day with additional two hour sessions at night. The teachers were given the opportunity to create permanent products for personal use or for school use during the day sessions. The evening sessions were designed for the development of technology infused lesson plans to be presented on the final day of the week-long session.

Mississippi Delta

The Mississippi Delta is a region of the state that is marked by casinos and cotton fields and set to the rhythm of the blues. This region of the state is known for its rich soil and its flat land. The major source of employment for Deltans is industry and catfish farming. With a very slow economy, many Delta school districts are desperate to improve the quality of the schools in order to improve the quality of life in the Delta. Many Delta school districts face a critical need for teachers. There are two universities located in the heart of the Delta. Both of these universities have teacher education programs that offer teacher certification for graduates. Despite the fact that these universities produce the teachers, the graduates opt to leave the Delta for more attractive economically desirable locations. Technology is not very prevalent in the Mississippi Delta schools. The schools struggle to operate on a yearly basis just to meet the demand for required material for the teachers. Many Delta schools receive technology assistance through educational grants that offer equipment to school teachers and school districts.

Despite such a bleak appearance, the Mississippi Delta has a creative legacy that includes more than the music of the blues that was born in the Delta. Playwright Tennessee Williams spent his childhood in the Delta and modeled many of his characters and locations after real people and places. The annual Tennessee Williams Festive includes tours of these locations as well as performances of the playwright's work. Thomas Harris, author of *Silence of the Lambs* and *Hannibal*, was also a Delta native. Southern writer Willie Morris grew up in Yazoo City and immortalized his hometown in the book *My Dog Skip*. Morris is buried 13 paces from the grave of the Witch of Yazoo, a site made famous by a film version of his memoir.

Participants

The participants of the summer teacher workshop were teachers and ET's from four schools located in CD2 and the Delta. The sizes of the school districts range from 944 students to 7942 students. According to the state accreditation rating ranging from one (lowest rating) to five (highest rating), the four school districts have an accreditation level of two. The participants were four math teachers, three social studies teachers, four language arts teachers, three science teachers, one gifted teacher who is the science representative for the school, and 3 ET's. The teachers' years of experience as a certified teacher range from none to 30 years.

Years Teaching Experience by Each Core Teacher

	Muddy Waters	Shelby Foote	Manning	Muddy Waters
Math	4	12	13	25
language arts	4	21	18	23
Science	10	18	18.5	24
social studies	30	1	8	not in attendance

The Study

In CREATE's first year of operation there was extensive and continuous communication between the teachers in the core schools and the CREATE staff. During this year, there were many visits made to the schools by the staff, and the teachers made visits to Mississippi State University for training. Because of the long distance e-communication that existed between these two entities, there was some miscommunication along the way the ultimately there were elements of mistrust that arose.

The lack of trust that existed between the staff and the teachers manifested itself in the form of weak relationships between the two. This manifestation hindered the excellence of the project on the part of the teachers and the CREATE staff. The teachers were not comfortable with presenting their problems to the staff or asking for assistance with problems related to their optimum achievement in their participation in the project. The staff was at a loss because they were unsure of how to communicate with the teachers to find out where their weaknesses were and how to help the teachers solve these impending problems.

The researchers were members of the evaluation team during the first year of the project which included schools from the Mississippi Congressional District 1 (CD1). They have discovered that the development of trusting relationships is vital to the growth of the teachers as a result of the project. Since a major component of CREATE for Mississippi is the mentor-model, the researchers examined how the teachers from CD2 felt about the training staff during the one-week workshop.

Findings

When working with teachers, the researchers have found characteristics in the trainers that help create effective relationships between the trainers and teachers. The trainers who understand the situations that teachers face in the classroom are more productive when instructing the teachers how to integrate technology into their curriculums. The trainers who view themselves as learners and understand how difficult learning new technology can be are also more helpful to the teachers. On the other hand, the trainers who are see themselves as experts on technology while viewing the teachers as less intelligent or less capable of learning technology are often viewed negatively by the teachers. These trainers are less effective with the teachers and eventually develop a negative working relationship with these teachers. These trainers have become frustrated with the teachers and eventually stop attempting to help the teachers learn about topic discussed.

The researchers found that the week-long training session was instrumental in helping to start the relationship development process. The teachers seemed hesitant to communicate at first, but as the week progressed, many relationships developed. Teachers from different schools developed relationships with each other, and the teachers developed relationships with the training staff.

The teachers were very open, down-to-earth people with one common goal which was to gain valuable experiences through technology training. The CREATE staff was very receptive and open to the teachers and made themselves readily available to the teacher at all times. Although during the training sessions the teachers sought help from any staff member available, there were two staff members in particular that the teachers relied on heavily on for assistance. These two staff members were Jimmy and Rose. Jimmy and Rose are two the newest members of the training staff. One interesting observation made about Jimmy and Rose is that many times teachers would pass up another staff member to get help from one of the two.

Rose is a young, energetic European American female. Rose has had experience teaching in the public schools as well as experience working with teachers in a grant-related position. Rose is responsible for serving as a liaison between the staff and the teachers in the schools. This position with the staff has offered her invaluable experience in knowing how to communicate with the teachers and developing and maintaining trust. The only problem that arose during the first year of the project with Rose was teachers associating her so closely with the other staff members. When the teachers were dissatisfied with the other staff members, they also felt negatively about Rose although she had nothing to do with the problem. As the year progressed, the teachers began to feel more comfortable with Rose.

Not only did the teachers at the workshop develop a professional relationship with Rose, but they were beginning to establish semi-personal relationships with her as well. Through the week, Rose used very personable language to communicate with the teachers, and she dressed in a very comfortable teacher-like fashion. She could often be observed practically running around the room wearing tennis shoes and her hair pulled back in a ponytail trying to answer the call of everyone who requested her help.

Jimmy is a young, technologically-gifted European American male. Unlike Rose, Jimmy does not have teaching experience. Jimmy has, however, used his savvy technology skills to conduct technology training workshops for several agencies. In addition to Jimmy's training experience, he has been a part of the business world. In this capacity, Jimmy's position was comparable to customer relations. This experience has offered Jimmy the skills needed to be a people centered person. Jimmy has also worked with the project for close to a year in a multifaceted capacity. The bulk of his responsibility was to go to the schools and conduct professional development sessions with the teachers. This experience has been a plus in helping Jimmy to effectively communicate with the teachers and in earning their trust. Jimmy, like Rose, could often be found throughout the week scurrying about offering assistance to the teachers during sessions.

The rest of the staff during this week were effective in their roles but did not establish a connection with the teachers like Jimmy and Rose. The teachers did not seem to respond to those staff members who were more formal in their manner and dress. The complaints from the teachers about these persons were that they were too serious, often boring, and not personable. Teachers complained that these trainers seemed to be unable to relate to them on their level of knowledge of technology and teaching.

On the last day of the session, the researchers used a questionnaire to discover how the teachers felt about the relationships that they built with the staff during the week. Through conversations, the teachers revealed that there were members of the training staff that they preferred not to ask for assistance. In direct contrast to this fact, all of the responses on the questionnaires were positive. On the questionnaires, none of the teachers mentioned being uncomfortable with anyone on the training staff. This may be attributable to the fact that the project manager was in direct contact with the teachers as they were completing the questionnaire. The teachers may not have felt comfortable enough to reveal their true feelings or the feelings that they expressed during casual conversation.

The researchers concluded that there were positive relationships developed between the staff and the teachers during the training session. The researchers believe that the working relationships between the staff and the new teachers for the upcoming years will be more beneficial to everyone involved for the success of the grant. It is the belief of the researchers that the teachers will relate better to staff members who are open and appear to be friendly. This study has shown that positive interaction fosters relationship building. Relationship building, in this case, creates the environment for a productive year for the CREATE project.

Assessing and Predicting ICT Literacy in Education Undergraduates

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Abstract: This study developed computerized testing procedures for selected procedural and declarative knowledge and skills of undergraduate students in an introductory, required instructional technology course. Examination of participant demographic information shows ICT skills seem to be rising as a function of increased exposure to technology in K-12 schools, but it is insufficient for mastery. In addition, a multiple regression model of predicting success based on intellective and non-intellective variables was tested. It was found that the intellective variable computer experience and the non-intellective variables gender and computer self-efficacy predicted ICT skills. The intellective variable general academic ability predicted declarative skills only (not procedural skills). Implications for individualized assessment and instructional programs are presented.

Introduction

In recent years, the view that Information and Communication Technology (ICT) is vital in K-12 education has become widespread. ICT use in schools has increased and various professional bodies have set ICT standards for students and teachers (e.g., ISTE, 1998; Alberta Learning, 2000).

When "embedded within practices and activities that realize its functionality for specific purposes and situations" (Réginald Grégoire inc. et al., 1996), ICT may contribute to various aspects of teaching and learning such as: (1) greater motivation, attention span and concentration, (2) stimulation toward deeper investigation of subjects, (3) cooperation and collaboration, (4) more authentic learning environments through simulations, virtual experiences, and graphic representations, (5) increased teacher interaction and mentoring, (6) more demanding forms of assessment, (7) better teacher access to learning resources, and (8) more collaborative professional development.

Questions abound as to whether teachers have the skills that their students are expected to attain (Milken Exchange on Educational Technology & ISTE, 1999) Schools of education are under pressure to produce teachers who are able to effectively integrate technology into their teaching. However, many teacher education programs do not adequately prepare teachers in ICT, nor assess candidates relative to ICT standards.

The Study

The objectives of this study were to: (1) develop a computerized system which assesses ICT declarative and procedural knowledge and provides a profile to the participant, (2) gather baseline information on the ICT Literacy of undergraduate Education students, and (3) determine whether there are characteristics associated with students with greater ICT expertise.

This study tested 713 undergraduate students at the start of an educational technology course (whose major focus was learning computer technical skills) and found generally weak ICT Literacy, with less than 10% of the students achieving a mastery level (80%). The students took the tests again at the end of the educational technology course and the results indicated a significant increase in the ICT Literacy level of the students. However, still only about half of the students achieved a mastery level on the tests. These results imply that teacher education programs should continue to take measures to increase the computer technical competency of students, as part of preparing pre-service teachers to teach with technology, and that a single computer technical course is not sufficient to raise all students to an adequate level of ICT technical competency.

This study also sought to identify characteristics associated with students who enter education studies with greater ICT expertise. A multiple regression analysis (Ma, 1997) revealed that pre-course ICT Literacy could be positively predicted by: variety of previous computer experience, amount of post-secondary computer-related studies (higher for students with science/technology focus rather than humanities), amount of ICT exposure in K-12 schooling, ownership of a home computer, general academic ability, gender (male), computer self-efficacy, and recency of high school graduation. Both declarative knowledge and procedural knowledge were predicted fairly similarly, with just one major difference. General academic ability was not a significant predictor for procedural skills, while recency of high school graduation was a significant predictor. Since academic ability is normally tested in a manner more similar to the declarative portion of the test (multiple-choice questions) than the procedural portion (practical hands-on tasks), it is not surprising that this variable significantly impacted declarative but not procedural scores. Recency of high school graduation likely impacted procedural skills because more recent graduates have had more opportunity for hands-on practice with computers in school than earlier graduates did.

Automated Assessment of ICT Skills

There was no existing instrument or data available which would have suitably assessed the ICT skill level of the post-secondary students who participated in this study. Commercial automated products such as SAM 2000 (Course Technology, 1999) are available for assessing individual expertise with particular application programs. These products offer an authentic type of assessment, in which the student must demonstrate skill acquisition in a live application environment or in a very realistic simulated environment. However, these products were not suitable for use in this study because they were limited to use on the Windows platform and to one particular version of applications such as Microsoft Word 2000 or Excel 2000 (Microsoft Corporation, 2000b); the computer facilities used in the study included both Macintosh (Apple Computer Inc., 2000) and Windows (Microsoft Corporation, 2000c) computers and various versions of software. There was also very little content in these products that addressed entry-level skills, and they generally did not allow for multiple methods for the student to produce a correct result for a given task.

In addition, various tools for self-assessment of ICT skills are available to pre-service or in-service teachers. Examples are the *California Technology Assessment Profile* (California Department of Education, 2002) and the *Professional Competency Continuum* (Milken Exchange on Educational Technology, 1999). Such tools are based on student self-reports and general checklists. This study required data from an objective, consistent test, in addition to student self-reports (this study collected some self-reported data concerning previous computer experience). For example, this study assessed what a student understands about using spreadsheets, by asking direct questions that require experience with various aspects of using such a tool, including performing particular operations using an actual spreadsheet program. It did not simply ask "Have you used a spreadsheet?" or "How well do you know how to use a spreadsheet?", which is what most self-reports would ask. Students may not be aware of how much they do not know about software tools. The lack of suitable tools for evaluating student ICT skills in this way justified development of new instruments.

Part 1 of the ICT literacy test developed in this study was called the ICT Knowledge Test. This test was a multiple-choice 30-minute test intended to measure declarative knowledge on ICT terminology and concepts. This instrument was presented to the students as a web-based HTML form and responses were collected via the Internet using an Active Server Page (Microsoft Corporation, 2000a) process. This process recorded their responses in a Microsoft Access (Microsoft Corporation, 2000b) database stored on a Windows server and returned a confirmation message to the student's web browser. In addition, responses were compared to the correct answers and the total score was automatically computed and stored in each student's database record.

Part 2 of the ICT literacy test was called the ICT Performance Test. Students completed a number of hands-on computer tasks which required a total of about an hour to complete. Each student was provided with a task list and a set of computer files that they were required to modify. The tasks were a sampling of the practical skills covered in the course and were limited to those requiring commonly available software and operating system functions (e.g., text/word processor, spreadsheet, copying/moving files). When the student completed the test, the modified files were then transferred via the Internet to the server. An automated scoring program immediately analyzed these files and stored the student's results in the database.

The Performance Test was a much more technically complex instrument than the Knowledge Test since it required automating the analysis of files that participants have manipulated on their local computers. There were many different programming methods which were considered prior to developing this instrument - the decision concerning which tools to use were based on criteria such as time constraints for the initial instrument development, minimizing problems in collecting data, and allowing the Performance Test to occur on either the Windows or Macintosh platform and with varying versions of application software. The solution chosen was to create a Visual Basic for Applications (VBA) (Microsoft Corporation, 2000d) procedure within the same Access database described earlier. Web-based (especially client-side) programming techniques were avoided because of variable client computer setup and security issues involved in attempting to examine files on a client computer over the Internet. This part of the system required uploading a set of files (combined into a single compressed archive) over the Internet to and from each participant's computer and the database server. During the Performance Test, the VBA procedure was continually running, monitoring a certain file directory every 60 seconds for arriving submissions and executing an automated scoring routine. The VBA scoring procedure implemented programming techniques (e.g., use of Microsoft Automation objects, methods and properties) which enabled automated execution of file system commands (e.g., file searches and directory listings), reading of text stream files, interfacing with external applications (e.g., Microsoft Word and Excel), opening files in these programs, and examining their object hierarchy.

After completing the tests, students were able to view their profile privately by entering their ID and password on a web-based form. The profile displayed their scores along with detailed information concerning the responses and correct answers to every item on the tests. After the post-test, the profile displayed both the pre-test and post-test information so that the student could assess their progress.

Conclusions

Regarding exposure to ICT in K-12 schooling it should be noted that the results only reflect the situation in the limited geographic area covered in this study. It was found that integrating ICT into a larger number of school subjects and starting ICT exposure earlier in school appear to have a positive impact on ICT Literacy, and this is increasingly evident in more recent graduates. Thus, one would expect that if ICT use in K-12 schools continues to increase, the ICT Literacy level of students entering post-secondary studies (in particular those entering teacher preparation programs) will continue to rise. K-12 schooling must be expected to provide a significant portion of a student's exposure to ICT, and the current situation (as per the baseline pre-course assessment) is that students overall do not appear to have enough exposure to ICT in their K-12 education. However, if the apparent trends discussed above are real, this situation should ameliorate with each passing year.

K-12 programs should also be aware of the characteristics associated with individual differences in ICT Literacy that have been identified in this study or in the literature. K-12 schools should continue to take measures to ensure that both boys and girls, both humanities and science-oriented students, and all students regardless of academic ability or family SES (especially access to a home computer), have ample opportunity for ICT experience. K-12 schools also have an important role to play in fostering positive attitudes and self-efficacy regarding the use of computers.

It is clear and perhaps obvious that exposure to computer technology in a variety of school contexts, homes and elsewhere is related to higher entry technical skills and knowledge. This raises some interesting issues. For example, to what extent is there a self-selection factor at work? That is, it might be hypothesized that students who have some sort of predisposition to work with computers are attracted to those courses that involve computers to the extent they have choice. If so, the suggestion of increasing the number of courses which use computers in order to increase literacy may have limited effect. An analogy to this logic is the argument that we reduce the sales of ice cream cones in the northeast because of the known correlation between ice cream cone sales and deaths by drowning. The fact that being male was a significant predictor in the multiple regression equation and that males tend to be more attracted to technology provides support for this hypothesis.

This study has demonstrated an applicability of automated testing to assess students' knowledge of ICT skills and procedures. Note that in the course, not all ICT skills were tested in an automated fashion: some were tested using conventional formats. One question to be raised is the reliability, validity, and usefulness of the automated testing process. Another is scalability: to what extent can a larger number and type of skills be successfully assessed using automated procedures? Increasing numbers of students and shrinking resources provide a practical impetus to this line of questioning. Potential benefits might include scalability, freeing of instructors' time to engage in assessment and instruction that demands more complex human judgment, and individualizing programs for improved learning and greater efficiency.

The age-old question arises, should every student in an instructional technology class be required to complete exactly the same assignments? Could we not create a system of individualization in which students would be directed to those learning assignments where their skills and knowledge is weak and in turn away from those learning assignments where their skills and knowledge is strong? Of course, this concept works well in theory but there are practical limitations. First, how does an instructor identify, among all the required basic skills and knowledge, which each student has acquired or not? Given hundreds of students and dozens of skills quickly renders this a task of unreasonable proportions. However, were all or the majority of the skills able to be assessed automatically, and via distance learning technology to boot, the logistics, operational problem could be solved. A second barrier is how to communicate, to each student, his or her profile of skill acquisition, that is what skills have been mastered and what skills have not? Individual student-instructor consultations with hundreds of students, some who may be studying as distance students is also prohibitive from a logistics point of view. However, results of automated testing can be generated through web-forms and delivered, individually, tailored to each student.

A third problem is remediation. For any given skill deficiency, what is the student to do to overcome it? Once again, if a specific learning activity with specific learning resources can be identified which will lead to a removal of a skill deficiency, the reporting system can also inform each student what they need to do in order to remove the deficiencies. Obviously such a system works best when the learning resources are available to students on a 24 X 7 basis.

Finally, there is the question of verification of acquisition of skills by students, so they can decide whether or not they need more study or can proceed to the next skill set. Because the assessment program has been automated, it can also be used by students to perform self-checks to determine what they have learned and still need to learn. In terms of using an individualized and computerized assessment system, it has been shown that (1) students' judgments about their own learning progress is often erroneous and (2) having access to an objective computerized testing system increases learning (Tennyson, 1981). These and other benefits of computer managed instruction systems are well documented (e.g., Szabo and Montgomerie, 1992). Plans for expanding the automated testing described herein into a full-blown CMI system are currently underway.

Further Research

Further research should be done on individual variations in computer usage. Cuban, Kirkparick & Peck (2001) identified 'open door' students whose computer competence enhanced their motivation and self-confidence to do well in school and opened doors to learning. These students were predominantly male, from diverse ethic backgrounds, and all had gained computer experience outside of school.

Another area identified for further research is adapting the instruments developed in this study for use in K-12 school environments for the purpose of longitudinal studies that would assess the ICT Literacy of students and determine if there is a trend towards increasing ICT use and ICT literacy in the geographic area covered by this study, in other regions in Canada and in other countries. Such K-12 studies may also be able to identify additional variables regarding ICT use in schools that will provide greater understanding of individual differences in ICT Literacy. This study only examined two simple variables related to the earliest grade of computer use and a count of the number of high school subjects that used computers. There are likely a host of other school-related variables that may increase our understanding of K-12 ICT Literacy such as school SES, school type, attitude of principal and other teachers regarding technology, expenditures on technology (e.g. hardware, software, and support), professional development opportunities, teacher ICT Literacy, student-computer ratio, level of Internet access, amount of time students have access to computers, level of sophistication in the use of particular software tools, and the complexity of projects completed using technology.

Further research should also be conducted into developing and implementing models for covering ICT in teacher education programs. Teacher education programs must help pre-service teachers increase their level of ICT knowledge and practical skills along with their understanding of integrating ICT into teaching. Improving the coverage of ICT in teacher education programs is a complex challenge; coursework is only one aspect of incorporating ICT into these programs. There are many factors that impact technology in pre-service teacher programs including faculty professional development, faculty incentives, funding, technology infrastructure, technical support, leadership, long-range planning, accreditation standards, technology use in K-12 schools, and technical competency of incoming students (Bielefeldt, 2001)

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Assessment of the Impact of the Gates Foundation's Teacher Leadership Project (TLP) as Reported by TLP Graduates, Their Principals and Teaching Peers

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Abstract: The Teacher Leadership Project (TLP) is a technology infusion effort funded by the Bill & Melinda Gates Foundation. The TLP provides K-12 teacher participants with technology infusion training and technology funding for participants' classrooms.

This presentation describes a study of the impact the TLP has had on its participants as reported by the TLP "graduates," their building Principals, and some of their teaching peers.

This study was designed to learn about some of the "ripple effects" of the Teacher Leadership Project. Are TLP graduates sharing their technology integration skills and techniques with others teachers in their school and district? What leadership roles have TLP grads assumed in the district? How has participation in the TLP impacted graduates' desire to pursue additional schooling or certification training? Are their broader district-wide impacts that are occurring because of the influence or activities of TLP graduates?

Introduction

This report describes results from a study designed to discover the impact Teacher Leadership Project graduates are having on their schools and school districts. This study solicited the input of the 407 teachers who graduated from the Bill & Melinda Gates Foundation's Teacher Leadership Project (TLP) between June 1998 and June 2000. Current TLP participants (graduates in June 2001) were excluded from this study.

Included in this report are: (1) background information on the TLP, including its goals and methodologies; and (2) results from quantitative and qualitative analysis of graduate impact surveys.

Background on the Teacher Leadership Project

In the summer of 1997, 27 teachers from public and private schools, in Washington State, came together to determine how best to use technology in their classrooms. These teachers developed a vision, mission and a staged model for implementation of technology as a learning tool across the curriculum. The model emphasized the relevancy of computing in the context of elementary education. It encouraged teachers to capitalize on integrative strategies. It encouraged teachers to plan, manage and reinforce computer activities as they would their other lesson plans and materials. It utilized a "teachers teaching teachers" development model.

In the fall of 1997, these teachers began to test their plan. The addition of new computers to participants' classrooms brought the student-computer ratio down to 4:1; each received a printer and a presentation device; and they began to infuse technology into their lessons. Not only were these teachers learning about using technology, they also had the equipment to begin testing the strategies for learning with their students.

A new environment emerged in the classrooms of TLP participants. Teachers reported that students often became teachers, and teachers learners. Students were engaged, curious and interested in active inquiry. TLP participants began collaborating with each other and serving as peer mentors. Participants adopted a mentoring, collaborating style of interacting. And through regular meetings and workshops, teachers had the opportunity to share and learn from their peers' new strategies.

As of June 2000, this program, the Teacher Leadership Project, had concluded its third year and had reached more than 400 teachers. These graduates are the population included in this study. The Teacher Leadership Project Impact Study was designed to learn about some of the "ripple effects" associated with participation and then graduation from the TLP.

Teacher Data Collection

Research participants in this study were teachers (mostly grades 4-8) who had attended and graduated from the Teacher Leadership Project (TLP). Participants came from public and private schools (K-20) located across the State of Washington.

Survey design took place during January and February 2001. The eight TLP Regional Coordinators who worked with the first three years of TLP participants (graduation years 1998 - 2000) were contacted via phone and interviewed. Regional Coordinators were asked to identify ways that TLP teacher participants were impacting their schools. Regional Coordinators' input fell into four impact areas: (1) training and development activities, (2) leadership activities, (3) personal development activities, and (4) other impacts to the participant or the school district and community. Two impact assessments were designed around these four impact areas.

Data collection took place throughout the state of Washington between April 3, 2001 and April 30, 2001. One hundred and forty five completed graduate impact surveys were returned to the researcher and used in this study. Two hundred and seventy one completed principal and peer surveys were returned to the researcher and used in this study.

Summary of Quantitative Data (Graduate Surveys)

The majority of TLP graduates who responded to the impact survey were female (73%) and over 40 years of age (63.8%). Most of the respondents teach grades 4 – 8 (90.8%) and have, on average, 15 years of teaching experience. Teachers indicated there were between 6 and 7 graduates in their school district; however, the respondent was typically the only TLP graduate in his/her school building.

Research Question Number 1

To what extent are TLP graduates engaged in ***training and development activities*** *and to what extent is their level of activity linked to their participation with the TLP?*

Survey data indicate that graduates are active in a majority of the identified training and development activities. In most cases, participants perceive that their participation in the training and development activities is strongly linked to their TLP experiences. Respondents most uniformly report they are engaged in the following training and development activities:

- Presenting informal technology training sessions for teachers in their school (94.4 percent participation)
- Engaging in informal peer mentoring activities (92.4 percent participation)
- Developing instructional materials, which are utilized by other teachers – tip sheets, integrative lesson plans, webquests, etc. (82.1 percent participation)
- Presenting formal technology training sessions for teachers in their school (70.3 percent participation)

Each TLP graduate trains, on average, 57 teachers in a typical school year. Courses taught fall into three categories: Microsoft Windows / Office / and other productivity software (49% of all courses taught); Integration / Curriculum topics (38% of whole); and Multimedia topics (13% of whole).

Research Question Number 2

To what extent are TLP graduates engaged in ***technology leadership activities*** *and to what extent is their level of activity linked to their participation with the TLP?*

Each of the technology leadership activities showed some level of participation by TLP graduates. Scores indicate that a majority of respondents are active in two of the listed technology leadership activities. A strong linkage was indicated between participant's involvement with the TLP and their participation in the listed technology leadership activities. Teachers most uniformly reported they were engaged in the following technology leadership activities:

- Led or assisted with development of district technology plan (56.9 percent participation)

- Led or assisted with district technology purchases (51.7 percent participation)
- Led or assisted with blending of district curriculum plans and district technology plans (47.5 percent participation)
- Led or assisted with evaluation of hardware and software or recommendation of standards for district hardware and software purchases (46.5 percent participation)

Research Question Number 3

*To what extent are TLP graduates engaged in **personal development activities** and to what extent is their level of activity linked to their participation with the TLP?*

While there was some level of participation by respondents in all of the listed personal development activities, a **majority** of respondents did not indicate their participation in any one of these activities. However, participants did indicate a strong linkage between their involvement with the TLP and their participation in the listed personal development activities. Teachers most uniformly reported they were engaged in the following personal development activities:

- Applied to participate in additional (post-TLP) grant funded technology training opportunities (46.2 percent participation)
- Received grant-funded training (other than 1st year TLP participation) (28.7 percent participation)
- Pursued formal schooling at university / community college pertaining to integration of technology into the curriculum (27.1 percent participation)
- Served at professional conference (22.5 percent participation)

Research Question Number 4

*To what extent have respondents observed or experienced **"other impacts to the TLP graduate or the school district and community"** following their completion of the TLP and to what extent do they perceive a link between these **"other impacts"** and their participation with the TLP?*

Survey data indicate that graduates agree that these "other impacts" are occurring in their schools and school districts. In most cases, participants perceive that the "other impacts" are strongly linked to the presence of TLP graduates in the district. A majority of respondents agreed to all six of the "other impact" statements:

- TLP graduates are viewed as role models by building or district administrators due to the graduates' technology infusion skills (95 percent agreement)
- TLP graduates are noticeably more enthusiastic and energized individuals after their TLP experience (94.9 percent agreement)
- TLP graduates are viewed as role models by many teachers in the building due to the graduates' technology infusion skills (94.3 percent agreement)
- TLP graduates are viewed as role models by many parents due to the TLP graduates' technology infusion skills (73.7 percent agreement)
- Parents have become more involved in the classroom and with their student's learning activities because of the TLP graduates' effective use of technology and discovery learning activities (60.3 percent agreement)
- The school or district's scope and sequence has changed due to the impact of TLP participants' technology infused discovery learning activities and TLP-funded technology rich classrooms (58.1 percent agreement)

Summary of Qualitative Data (Principal and Peer Surveys)

Two hundred and seventy one completed principal and peer surveys were returned to the researcher and used in this study. Individual comments, provided by principals and teaching peers appear below. Information in these comments that would identify the graduate or the graduate's school district has been changed to respect the anonymity promised to respondees by the researcher.

Principal & Peer Survey Question Number 1

*"Please identify any changes in the individual's involvement with **training and development activities** that you believe can be attributed to his/her participation in the TLP."*

Responses were clustered into the following themes:

TLP graduates have a significant positive impact on the school and community: For example, "The TLP is a wonderful blessing to small, rural schools. This TLP graduate is a visionary and yet practical, always involved in training in our building, district, and across the state and nation. This TLP graduate is a chief advocate for change and development of our technological resources and skills."

TLP graduates provide training and other assistance: For example, "As a result of the TLP, Kate has become a confident technology trainer for teachers in our building and our district. She has provided training sessions in the areas of Microsoft Word, PowerPoint, and Excel. She has demonstrated ways to integrate technology into the curriculum and acted as a Master Teacher and mentor for novice technology users."

TLP graduates are peer mentors: For example, "On a personal basis Janelle has been available always, for me to receive training on programs, which are coming on newer computers I'm receiving through the levy funds. She has done staff inservice demonstrations on School Kit, PowerPoint, and Word and hands-on workshops with the computers in her room (middle school staff of 8 teachers). Had she not shown how simple it was to use PowerPoint (for instance) I might not be using it."

TLP graduates model the principles of the Teacher Leadership Project: For example, "Sara offered a school-wide inservice for classified and certificated staff, all functioning at various levels of computer competency. She led us through a variety of activities, including those which involved scaffolding techniques to build lesson plans and curricular structures using templates and introduced us to Schoolkit and other invaluable programs. Each of us, with Sara's leadership and guidance, came away with increased understanding and lesson structures individualized to the specific needs of our own classroom."

TLP graduates have a significant impact on students and student learning: For example, "Ms. Hall did lots of computer training and development activities with her students. Her 6th grade social studies class did Western Hemisphere MS PowerPoint presentations, while her 7th grade social studies created Eastern Hemisphere PowerPoints, Siberia brochures using MS Publisher, and constructed and read graphs in preparation for the WASL. Her 8th grade social studies did a yearlong research paper written in a magazine format, which used MS Word documents and Internet research. The students also used Word to write reports, which were presented, to the public."

Principal & Peer Survey Question Number 2

*"Please identify any changes in the individual's involvement with **technology leadership activities** that you believe can be attributed to his/her participation in the TLP."*

Responses were clustered into the following themes:

TLP graduates have a leadership role in the school district: For example, "She has been vocal in decisions being made in the district. Because of this training, the district listens to her ideas. She is our school's technology leader and is also a leader at the district and state level on the use of instructional technology."

TLP graduates model the principles of the Teacher Leadership Project: For example, "It was Janet who first raised the idea of an in-district version of TLP. She and two other TLP teachers have taken the lead in planning and instructing at our in-district session."

TLP graduates have a significant impact on students and student learning: For example, "Sara has almost single-handedly developed a core of students whom she has trained as "tech kids," literate in a variety of computer skills and competencies and able to troubleshoot problems and difficulties which might arise in the computer lab or in the computers in our classrooms. These students have a helpful and problem-solving approach and a sense of pride in what they do. This program is a direct result of Sara's instruction. In addition, Sara works collaboratively with our computer lab instructor and the other TLP participant in our school, in developing a scope and sequence and Essential Learnings in Technology, both in terms of committee work at the district level and site decisions at our school."

Principal & Peer Survey Question Number 3

*"Please identify any changes in the individual's **personal or professional development activities** that you believe can be attributed to his/her participation in the TLP."*

Responses were clustered into the following themes:

Many TLP graduates pursue additional training due to their TLP experience: For example, "With the leadership role she has evolved into, she is now convinced that she should complete her Masters Degree with a major in administration. She will make an excellent principal!!"

The TLP energizes many of its graduates to continuously renew their skills: For example, "Mr. Flynn continues to grow through reading and participation. His teaching practices will be even better next year than they were this year—high praise for a state finalist for Teacher of the Year. I'm sorry if I sound like his mom, but this guy is unbelievable!"

TLP graduates model the principles of the Teacher Leadership Project: For example, "I believe as a professional educator, Jim promotes technology through leading by example. His professional involvement in school district activities has shown others that technology can and does work well with our existing curriculum that is required to be taught."

TLP graduates have a significant impact on students and student learning: For example, "Claudia intentionally looks for *appropriate* use of technology as she crafts her lessons and units. She leads a Science Team and has incorporated robotics into her program. She was anxious about the PCs her first year but has grown by leaps and bounds over the next 2 years. It takes *time* to develop skills in using tech—and Claudia keeps growing!"

Principal & Peer Survey Question Number 4

*"Please identify any **impacts to the school district** that you believe can be attributed – either wholly or partially – to the influence of TLP graduates in the district."*

Responses were clustered into the following themes:

TLP graduates have a significant positive impact on the school and community: For example, "It is hard to say where we'd have been without it. However, I do know we have entered an exciting world, and a great deal of that is due to Rachel. Thank you so much for the opportunity."

TLP graduates model the principles of the Teacher Leadership Project: For example, "We have had others teachers apply for the TLP. Teachers at our school, along with teachers from other Catholic schools in our city took the course offered this past year on technology integration in math and science. Her expertise is recognized in the classroom and as part of the technology committee. Debbie has been a very positive influence for technology."

TLP graduates have a significant impact on students and student learning: For example, "WOW! For the kids it has been a HUGE impact. They are creating projects, researching, and gaining computer skills that enhance their learning. As each school has sent people to TLP, parent groups and other staff members have seen the benefits of TLP and are seeking out training in their buildings. This is a GREAT program!"

Parental and Community impressions of the school district is enhanced due to TLP graduates: For example, "Many parents have expressed a concern about the minimal use of technology in our district. Because of the teachers who have participate in this project, the administration has seen a HUGE number of teacher request from parents who wish their children to be in one of the "classrooms with all the computers in them" as a result, the district is increasing budgets to provide more computers and software for all the buildings – something we have had little support for in the past."

Summary

Both quantitative data, collected from TLP graduates, and qualitative data, collected from their principals and teaching peers, indicate that TLP graduates are having a dramatic positive impact on their teaching peers, their schools and school districts, students, parents, and other members of the community. The impact is significant as shown via this study.

Graduates are engaged in a variety of activities in the areas of training and development and technology leadership. They continue to enhance their professional credentials via schooling and other professional development activities. Administrators, teachers, and parents perceive TLP grads to be technology leaders. Graduates are more enthusiastic in their teaching following their involvement with the TLP. Participants contribute greatly to the technology integration efforts in their schools and school districts.

Respondees have stated that TLP participation has, in fact, been a life-changing experience. The Bill & Melinda Gates Foundation, and the teacher-founders of the TLP, can be assured that the impact of the TLP is being felt in many ways beyond participants' initial involvement with the program.

Schools, universities, and other organizations across the country who wish to implement a technology-infusion program that produces demonstrable and measurable long-term impact on teacher participants, students, schools and school districts should consider the example of the highly successful Teacher Leadership Project in Washington State.

For Additional Information:

The full *Teacher Leadership Project – Impact Study* (Spring, 2001) and other technology infusion evaluation reports can be found at: http://www.gatesfoundation.org/education/evaluation/default.htm

Simulating and Evaluating the Yekioyd Methodology

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Abstract:

The Yekioyd family of statistics provides a method of evaluating the consistency of test items with overall test scores. Their purpose is to aid an educator in developing tests by identifying weak test items. This simulation study at hand provides an analysis of these statistics in a variety of circumstances reflecting the concerns of the educator. We find that the statistics have highly desirable properties under all circumstances.

The relationship between the Yekioyd statistics and the literature on item analysis has been covered elsewhere (Dickey and Zachary, 2001). The only tools of item analysis that are in any way related to the Yekioyd statistics are the homogeneity indices proposed by Long (1934) and Loevinger (1948). The statistics analyzed in this paper are the product of taking the alternate direction to the Long/Loevinger approach. Assume that the information set consists of a binary for the test item for each student and overall student scores. The Long/Loevinger approach orders the data by the binary and counts contradictions occurring in the corresponding sets of scores. The Yekioyd statistics order the data by overall scores and count contradictions in the order taken by the binary. Given the current state of development of the homogeneity statistic, the Yekioyd statistic offers advantages. It features an exact interpretation because of its mathematical formulation. In our previous paper, we demonstrated that Yekioyd procedure is readily subjected to natural weighting schemes that increase its functional value to the educator. These weighted statistics are the upper Yekioyd, YU and the lower Yekioyd, YL. The basic Yekioyd statistic, YB, is unweighted.

n is the number of test questions, p is the proportion of students answering correctly, and q is the proportion of students answering incorrectly. The weighting scheme built into these statistics is based on ordering student responses to a test item by their overall scores in column style with scores declining as one moves down the column. A division line (boundary or B value) is created between the upper np students and the lower nq students. For each range, the deviation variable D is constructed. Its value is one for all upper range students who answered incorrectly and all lower range students that answered correctly. Otherwise, its value is zero. For each student, a value of the weighting variable W is constructed from the student's score and B. In the upper range, B is subtracted from the student's score. In the lower range, the student's score is subtracted from B. W is not a weight in its own right. The actual weight given to a deviation occurring with a particular student is the W value associated with that student divided by the base for the weighting. In each range, the base for weighting will be the summation of W values in that range.

The resulting construction is a weighted statistic that reflects the greater undesirability of deviations that occur far above or far below the line of division between the upper and lower ranges. Such weights should reflect the distance from the line of division to the number line location at which the deviation occurred. This division point will be calculated by the average of the scores of the two students on the boundary of the np/nq division. This average serves as the boundary value, B.

In order to achieve comparability across questions with varying p values, both statistics will be scaled by a factor reflecting the number of locations for deviations divided by the number of possible deviations. The maximum number of possible deviations in each of both ranges is the smaller of np and nq. Our notation will represent this smaller one of the two values with (np:nq).

Let i be the index of the rank order of student scores, with 1 assigned to the highest student score and n assigned to the lowest student score. The basic Yekioyd and the weighted statistics are:

$$YB = \frac{\sum_{i=1}^{n} Di}{\text{the smaller of } 2np \text{ or } 2nq}$$

$$YU = \frac{\sum_{i=1}^{np} Wi(Di)}{\sum_{i=1}^{np} Wi} \times \frac{np}{(np:nq)}$$

$$YL = \frac{\sum_{i=np+1}^{n} Wi(Di)}{\sum_{i=np+1}^{n} Wi} \times \frac{nq}{(np:nq)}$$

Interpretation of these statisitcs is based on the following table. The table applies the assumption that nq < np. Otherwise, np would appear instead of nq, with no change in implications.

Yekioyd Value	Deviations Not Occurring	-	Deviations Occurring	=	Net Contribution To Consistency
1.0	0		2nq		-2nq
.75	.5nq		1.5nq		-nq
.50	nq		nq		0
.25	1.5nq		.5nq		nq
0.0	2nq		0		2nq

The weighting in YU and YL precludes a simple analysis of their properties. For this reason, simulations were performed to display their properties. Two conditions were imposed on the simulations to achieve neutral comparability. These conditions are that YB is constant across the questions and that the locations of deviations in the rank order of student performances be comparable across questions. The simulations will have 20 student scores ranging from 98% to 60% in increments of 2% in consecutive numbers. This distribution of grades makes it possible to perform exact interpolation in several instances. There will be 9 questions labeled Q1 through Q9 with p values ranging from .9 to .1 in increments of .1.

In order to be evaluated on mathematically comparable locations of deviations, case definitions will be framed in terms of given YB values. The YB values of .25, .50, and 1.0 are interpreted in the case definitions as 1/4th of a range, 1/2 of a range, and the whole of a range. The concept of centering used here means that the deviations are clustered about the middle of the range segment with equal numbers of deviations equally spaced on either side. The case definitions are:

High Concern Case: When all deviations are centered in the upper YB portion of the YU range or centered in the lower YB portion of the YL range.

Low Concern Case: When all deviations are centered in the lower YB portion of the YU range or centered in the upper YB portion of the YL range.

Intermediate Case: When each range contains its deviations centered around the middle of the range by rank order.

Values of the Simulation Matrix:

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
	p=.9	p=.8	p=.7	p=.6	p=.5	p=.4	p=.3	p=.2	p=.1
	B=64	B=67	B=71	B=75	B=79	B=83	B=87	B=91	B=95
Score	W1	W2	W3	W4	W5	W6	W7	W8	W9
98	35	31	27	23	19	15	11	7	3
96	33	29	25	21	17	13	9	5	1
94	31	27	23	19	15	11	7	3	1
92	29	25	21	17	13	9	5	1	3
90	27	23	19	15	11	7	3	1	5
88	25	21	17	13	9	5	1	3	7
86	23	19	15	11	7	3	1	5	9
84	21	17	13	9	5	1	3	7	11
82	19	15	11	7	3	1	5	9	13
80	17	13	9	5	1	3	7	11	15
78	15	11	7	3	1	5	9	13	17
76	13	9	5	1	3	7	11	15	19
74	11	7	3	1	5	9	13	17	21
72	9	5	1	3	7	11	15	19	23
70	7	3	1	5	9	13	17	21	25
68	5	1	3	7	11	15	19	23	27
66	3	1	5	9	13	17	21	25	29
64	1	3	7	11	15	19	23	27	31
62	1	5	9	13	17	21	25	29	33
60	3	7	11	15	19	23	27	31	35

Σ Wi

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
YU	324	256	196	144	100	64	36	16	4
YL	4	16	36	64	100	144	196	256	324

Scaling Factors

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
YU	9	4	2.33	1.5	1.0	1.0	1.0	1.0	1.0
YL	1.0	1.0	1.0	1.0	1.0	1.5	2.33	4	9

Σ Wi ÷ Scaling Factor

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
YU	36	64	84	96	100	64	36	16	4
YL	4	16	36	64	100	96	84	64	36

Three sets of simulations were performed on the nine questions. These corresponded to YB values of .25 for set one, .50 for set two, and 1.0 for set three. With the case definitions provided earlier, all questions examined exhibited identical YU and YL statistics. These statistics are shown below.

		High Concern		Low Concern		Intermediate Concern	
Set	YB	YU	YL	YU	YL	YU	YL
1	.25	.438	.438	.063	.063	.250	.250
2	.50	.750	.750	.250	.250	.500	.500
3	1.0	1.00	1.00	1.00	1.00	1.00	1.00

The weighting scheme is intended to cause a decrease in sensitivity to deviations near the boundary and an increase in sensitivity to deviations far from the boundary. The results of the simulations confirmed the characteristics just noted. For any value of YB < 1, YU and YL will be above YB in the high concern case and below YB in the low concern case. In the intermediate case, the weighting is neutral in its effect, producing values for YU and YL that are equal to YB. In sets 1 and 2, the effect of the weighting between high concern and low concern cases appeared to be symmetric, e.g. (.438+.063)/2=.25 and (.750+.250)/2=.50. When YB = 1, YU and YL were forced to 1 either because all locations in a range had deviations or because the centering as set forth in the case definitions induced the same result via the mean of the weights at the centered location.

The operating principle in the preceding simulations was that the educator's concern with a deviation is indicated by its distance from the boundary measured by overall scores. If this view is accepted, then the cases are comparable on the basis of the educator's concern as well as mathematically comparable. In the measurement of YU, the high (low) concern case is a worst (best) case scenario if $p \leq .5$, but not if $p > .5$. This means that when a question has a $p > .5$, a condition can occur that is worse or better than is possible for questions where $p \leq .5$. In the measurement of YL, the parallel is when $p < .5$. In terms of the educator's concern, questions with different p values have different potentialities. YU and YL can reflect the extent of these differences. In order to explore this question, the simulations were repeated with case definitions that were not comparable situations across questions with different p values. These case definitions were:

Worst Case: When each range contains its deviations located as far from the boundary as possible.

Best Case: When each range contains its deviations located as close to the boundary as possible.

Set One: YB = .25 (i.e. 25% of all possible deviations occur) Questions 1, 3, 5, 7, and 9 are intractable because 25% of np and nq are not integers and deviations must occur in whole units.

Worst Case:

	Q2	Q4	Q6	Q8
YU	.484	.458	.438	.438
YL	.438	.438	.458	.484

Best Case:

	Q2	Q4	Q6	Q8
YU	.016	.042	.063	.063
YL	.063	.063	.042	.016

Set Two: YB = .50 (i.e. 50% of all possible deviations occur)

Worst Case:

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
YU	.972	.938	.893	.833	.750	.750	.750	.750	.750
YL	.750	.750	.750	.750	.750	.833	.893	.938	.972

Best Case:

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
YU	.028	.063	.107	.167	.250	.250	.250	.250	.250
YL	.250	.250	.250	.250	.250	.167	.107	.063	.028

Set Three: YB = 1.0 (i.e. 100% of all possible deviations occur)

Worst Case:

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
YU	1.89	1.75	1.57	1.33	1.00	1.00	1.00	1.00	1.00
YL	1.00	1.00	1.00	1.00	1.00	1.33	1.57	1.75	1.89

Best Case:

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
YU	.111	.250	.429	.667	1.00	1.00	1.00	1.00	1.00
YL	1.00	1.00	1.00	1.00	1.00	.667	.429	.250	.111

As YB goes to 1.0, the effect of the weighting scheme diminishes to 0 for all situations where a deviation will occur at every location. The YU statistic for a high p question and the YL statistic for a low p question do not have this limit property. In these situations, the weighting scheme continues to function even at YB = 1.0. This allows YU and YL to provide an indication as to the severity of differences in questions. When YB is .25, the difference in high p questions and a question with a p value of .5 was very small with observed differences ranging from negligible to as much as .046. As YB increased to 5, the observed differences rose to as much as .222. When YB reached its limit at 1.0, a difference of as much as .89 was observed. This means that the worst (best) case for a question with a p value of .9 can be 89% worse (better) than the worst (best) case for a question with a p value of .5.

Overall, we are left with the perspective that high or low p questions do little good for or harm to a test's consistency in terms of the number of deviations occurring or not occurring. None the less, such questions can do either considerably more harm or considerably less harm per occurrence of a deviation than questions with p values near .5 if YB is high. YU and YL indicate whichever the situation is and provide a useful measure of its extent.

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Effects of Training in an Interactive Television Environment

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Abstract: The purpose of this study was to determine if formal distance education classroom training or classroom training combined with laboratory experiences would affect the concerns of college faculty and administrators about the implementation of interactive television (ITV) in their institution. Twenty-seven faculty and administrators employed full-time in the fall semester at Texas State Technical College-Marshall participated in the study. The instrument used to collect the data was the Stages of Concern Questionnaire (SoCQ). The quasi-experimental study utilized a pretest posttest control group design utilizing three groups with Analysis of Covariance (ANCOVA) used to analyze the data. The results of this study indicated that classroom training and laboratory experiences were effective in assisting college faculty and administrators in progressing more rapidly through the stages of concern when confronted with teaching in an ITV classroom.

Introduction

In 1997-1998, 54% of the public two-year and four-year higher education institutions in the United States offered courses via two-way interactive television (ITV). At that time, 61% of the respondents indicated that distance education delivery utilizing two-way interactive video would start or be increased by their institution within the next three years (National Center for Education Statistics [NCES], 1999). However, only about a quarter of higher education institutions offering distance education courses required faculty to have training in distance education instructional methodologies (NCES, 1999). The implementation of two-way interactive video classes can be an expensive venture for an institution, yet the research indicates that training does not seem to factor into the process.

ITV instruction presents a change in teaching methodologies for traditional face-to-face teachers. In their groundbreaking work on change, Hord, Rutherford, Huling-Austin, and Hall (1998) wrote, "the single most important factor in any change process is the people who will be most affected by the change" (p. 29). Even though the technology and the institution are important to the successful implementation of a distance education program, the faculty, staff, and administrators utilizing the system are the most important factors in successful implementation (Hord, Rutherford, Huling-Austin, & Hall, 1998). Moore and Kearsley (1996) suggested that success of a distance education program in an institution is dependent upon the internal commitment by the teachers and others within the organization. However, training for faculty utilizing ITV systems is seldom offered.

As institutions begin to utilize distance education technologies, it is important that instructors have the advantage of training in the new instructional approaches. Implementing a successful distance education program, in this case, ITV, for the institution is critical to the sustainability and expansion of the college. Because change is a process, administrators and faculty must embrace the new innovation for a successful and profitable distance education telecommunications program (Hord, Rutherford, Huling-Austin, & Hall, 1998). Personnel must be given the necessary training to alleviate their stages of concerns about the new innovation, ITV, so that the change process can be accomplished and successful implementation of the innovation can occur. These premises provided the bases for this investigation.

The Study

This research was conducted at Texas State Technical College-Marshall (TSTC-M), which is located in Marshall, Texas, a rural East Texas town of approximately 25,000 people. The college is part of the TSTC system, the only state-supported technical college system in Texas and new to the use of ITV for instructional purposes. Twenty-seven full-time faculty and administrators of the college volunteered to participate in the study. The participants were divided into three groups with the first group receiving classroom instruction and hands-on activities in ITV methodologies. The second group received classroom instruction only. The third group served as the control group for the study and did not receive any training.

Each participant in all three groups received the 35-item Stages of Concern Questionnaire (SoCQ) on the first day of the scheduled classroom training. The control group attended the first fifteen minutes of the first scheduled classroom training to complete the survey. Once their survey questionnaire was returned, the control group members were dismissed from the classroom training session. Respondents indicated on a Likert scale the degree to which each concern was true and circled a number from 0 to 7 on the printed scale. Respondents were given as much time as necessary to complete the survey before actual classroom training began. Each series of the questionnaire consisted of items that are important at a certain stage of concern, according to the Hall, George and Rutherford (1986) concerns theory. Each of the seven stages of concern was represented by five questions on the survey. A scale score was obtained for the peak score and for each of the stages of concerns on the questionnaire.

After the SoCQ was completed, the researcher presented nine hours of classroom instruction in distance education methodologies to the 18 participants in groups two and three. Each group met one day every second week for three hours of instruction. Classroom training consisted of three, three-hour sessions over six weeks of instruction. Participants took part in discussion and hands-on activities that familiarized them with the technology and the necessary skills for teaching in an ITV classroom. At the conclusion of the last classroom session, the participants who elected to end their training with the classroom portion were administered the SoCQ as a posttest. The classroom and laboratory group was comprised of the faculty and administrators who wished to receive college credit for their participation in the classroom sessions. In order to receive credit, this group participated in 18 hours of individual, hands-on practice in the distance-learning classroom in addition to the classroom instruction. Logs were maintained by the participants and kept in the ITV classroom. Logs were reviewed by the researcher and by the Dean of Instruction for TSTC-M to ensure that each participant completed the required 18 hours of practice. Participants presented a 15-minute lesson in the ITV classroom to a remote site as part of their course requirements for credit at the conclusion of the training and hands-on experiences. Upon completion of the presentations, the SoCQ was administered to the classroom and laboratory group and to the control group.

Findings

When using the SoCQ, Hall, George and Rutherford (1986) recommended two methods of dealing with group data. The first method tallies the number of individuals that score high on each stage to obtain the range of peak stage scores within a group. Peak scores are related to the stage definitions in the questionnaire. The authors noted that "the higher the score, the more intense the concerns at that stage. The lower the score, the less intense the concerns at that stage (p. 31). The second method, and the method utilized in this study, is to "aggregate individual data by developing a profile that presents the mean scores for each stage of the individuals in the group" (p. 32). The aggregate score was derived from the sum of the responses given to the five questions addressing each stage of concern. The total stage raw scores for each of the participants in each group were used in the ANCOVA test to determine differences among the groups. The results of the study are presented in Table 1.

The initial pretest score on the Stages of Concern Questionnaire was used as the covariate in this study. Analysis of covariance (ANCOVA) was used to adjust for initial differences between groups before a comparison of the within and between groups was made. Gall, Borg and Gall (1996) suggested "the preferred statistical method is analysis of covariance in which the posttest mean of the experimental group is compared with the posttest mean of the control group with the pretest scores used as a covariate" (p. 496). Independent t tests of least squares means, Tukey, were conducted on the comparison results of the groups to determine which differences between and among groups were significant.

Results of the data analysis for the experimental populations in this study indicated that significant differences favoring the experimental strategy for the classroom combined with laboratory experiences group occurred in four of the seven stages of concern at the $p < .01$ level of confidence.

Concerns research shows that concerns change over time in a developmental manner. Because this is true, professional development for faculty and administrators should address the stages of concern in a progressive manner if the innovation is to be effective. The sum of the responses to the five questions addressing the seven stages of concern should show the progressive development of an individual or group moving from a high awareness or self concern to the refocusing concern that indicates acceptance and willingness to implement an innovation (Hall & Hord, 1987).

When evaluating the classroom and laboratory group in this study, the analysis of the data indicated that this group had shifted its focus away from concerns primarily about self and had begun to evaluate the management, consequence, collaboration, and refocusing stages that are essential for the new innovation, distance education, to be successful at TSTC-M.

High concerns in stage 3 for the classroom and laboratory group indicated that this group was concerned about logistics, time and management concerns. The highest adjusted mean score for the classroom and laboratory group occurred in stage 4. This indicated that the group had concerns about the effects of distance learning on students. Their next highest adjusted mean score was in the adjacent stage 5, collaboration. This indicated that the group had concerns about the collaborative efforts of distance learning. The high score on the refocusing stage, with a low score in the awareness stage, indicated that the individuals who had participated in classroom and laboratory experiences were concerned about its effects on students. They were also concerned with collaboration efforts to make distance education more effective for students involved in the process.

The analysis of the data of the classroom group in this study showed a significant difference at the $p < .01$ level of confidence in two stages of concern. The highest adjusted mean score for the classroom group was in stage 5, collaboration. A significant difference between the classroom and the classroom and laboratory groups appeared at this stage. A significant difference between these two groups also occurred in the consequence stage. These differences indicated that classroom training was beneficial to both groups but the actual laboratory experiences helped the faculty and administrators feel more comfortable about distance education. The classroom group also showed a significant difference from the classroom and laboratory group in the impact dimension. This shows that the classroom training made the group more aware of distance education but faculty and administrators need the additional laboratory experiences before beginning instruction in the distance learning classroom.

The control group profiles in this study align with that of the nonuser in the stages of concern. The concerns of nonusers are typically the highest on stages 0, 1, and 2, and typically lowest on stages 4, 5, and 6. The highest adjusted mean score for the control group occurred in stage 1. This indicates that the group was more concerned with personal position and well being in relation to the change. With the second highest adjusted mean score falling in stage 5, the results of the ANCOVA suggested that the control group was also highly concerned with working with others. The "tailing-off" stage 6 indicates that the group did not have ideas that compete with the distance education innovation. The responses for the control group followed the typical pattern of a nonuser of distance education. This group appeared to have little interest in distance education.

The classroom and laboratory group progressed steadily through the Stages of Concern with the aid of training and laboratory experiences. The classroom group made some developmental moves but adjusted means were not significant. The graphic view of the control group results resembled the profile of the typical nonuser described by Hall, George, and Rutherford (1986).

The results of this study should not be generalized to extend to other institutional groups without comparative data. The findings must also be viewed with limitations specified by the experimental design, the participating faculty and administrators, the researcher, the questionnaire, and the statistical analysis.

Analysis of Covariance Results of Stages of Concern

Stage of Concern	adjusted mean(se)		F-value	Probability
Awareness			1.03	ns
	Training +	8.39 (1.64)		
	Training	10.07 (1.63)		
	Control	11.87 (1.70)		
Informational			.79	ns
	Training +	17.47 (1.68)		
	Training	14.76 (1.85)		
	Control	15.43 (2.18)		

Personal			2.32	ns
	Training +	18.97 (2.40)		
	Training	13.97 (2.79)		
	Control	11.62 (2.82)		
Management			7.04	p < .01
	Training +	17.11 (1.93)		
	Training	11.97 (2.11)		
	Control	6.47 (2.11)		
Consequence			7.70	p < .01
	Training +	21.99 (1.88)		
	Training	14.61 (2.12)		
	Control	11.51 (2.22)		
Collaboration			7.14	p < .01
	Training +	21.53 (1.24)		
	Training	17.00 (1.31)		
	Control	14.14 (1.61)		
Refocusing			6.52	p < .01
	Training +	16.51 (1.77)		
	Training	11.50 (2.39)		
	Control	6.55 (2.44)		

*indicates significant difference between means designated *
+indicates significant difference between means designated +
#indicates significant difference between means designated #

Table 1: Analysis of Covariance results of the Stages of Concern 0-7 by group

Conclusions and Recommendations

Based on the findings of this study and recognizing the limitations stated in the previous section, the following conclusions were drawn:

1. The classroom training combined with laboratory experiences strategy was more effective than classroom instruction only or no treatment for addressing concerns, of college faculty about the innovation of distance education.
2. The classroom training combined with laboratory experiences strategy was more effective than classroom instruction only or no treatment to prepare faculty and administrators for teaching in a distance education classroom.
3. The classroom training combined with laboratory experiences strategy was more effective than classroom instruction only or no treatment to help faculty and administrators move from the early stages of concern, awareness, informational, personal, to the task and impact stages of concern of management, consequence, collaboration, and refocusing.
4. The SoCQ was an effective instrument for evaluating faculty and administrator concerns about the innovation of distance education.
5. Classroom and classroom combined with laboratory experiences are important to the successful implementation of distance education platforms.
6. Faculty and administrators will be more willing to accept and institutionalize the new innovation of teaching in a distance-learning environment as a result of classroom instruction and classroom instruction combined with laboratory experiences.
7. Professional development in distance education methodologies should be offered to faculty and administrators to address their concerns, about the new innovation and to

increase institutionalization of the innovation.
8. The results of this study corroborate the evidence found in the review of the literature that classroom training combined with laboratory experiences should be provided to all users of telecommunications systems.
9. Training in distance education methodologies is a critical component for successful institutionalization of an innovation.

Determining if classroom training and classroom experiences aid in the smooth acquisition of the innovation of interactive television classes provides pertinent and useful data on how higher education administrators and faculty embrace and adapt to change as measured by the SoCQ. This study was conducted under the assumption that personnel implementing distance education programs desire a smooth and successful acquisition of the innovation.

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New Teachers and Technology: Positive Factors

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Each of us involved in encouraging technology for learning can list factors that inhibit the use of technology in schools. The lack of skills, confidence and tools are the usual suspects. When all these are present, many teachers still choose not to use technology. This study looks at five first year teachers who are using technology in order to determine the factors that encouraged them to be active technology users.

The subjects were selected from a pool of recently licensed teachers from eleven teacher education programs who are members of a PT3 consortium in a western state. Each program nominated teachers who were believed to be using technology in their first teaching position. Those nominated were selected based on their self-described use of technology, location in the state, grade level taught, and the students they served. The five subjects selected all are high technology users and represent the range of grade levels, locations, and settings.

The subjects will be observed twice, once in the fall and once in the winter. During these observations, the teachers, their colleagues, and their supervisors will be interviewed. The data will be analyzed to determine which factors lead to the teachers using technology in their first year. The ISTE/NETS list of Essential Conditions will serve as a starting point. We will also consider factors from the literature on the adoption of innovations and compare the strategies used to teach these teachers about technology.

Data collection will be completed before the SITE Conference. The purpose of this short paper will be to share our preliminary findings and receive feedback from the session participants.

An Analysis of the Influence of Gender, Grade Level, and Teachers on the Selection of Mathematics software by Intermediate Students

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Abstract: The purpose of this study was to investigate the relationships between gender, grade level, teachers, and the selection and use of mathematics software as measured by the type of mathematics software chosen, time-on-task, and reasons given for selection. Research data were collected from 202 third, fourth, and fifth grade students in a single elementary school located in northeastern Colorado.

This study investigated gender preferences of intermediate level elementary students. The overarching research question was: What relationship is there between gender, grade level, teachers, and the selection and use of mathematics software as measured by the type of mathematics software chosen, and time-on-task?

Results from this study add to the gender bias knowledge base and provide suggestions for software developers for improving movement toward gender equity in software design. The future for women in the field of technology is tenuous at best (Harrell, 1998). The obstacles females face eventually translate into highly paid men dominating the engineering and computer science arenas while women are relegated to data entry and word processing (Hakansson, 1990; Henwood, 1993). This study gave insight into factors that may influence this trend during the age range where females begin to lose their interest in computing, between third and fifth grade (Harrell, 1998; Hopkins, McGillicuddy-DeLisi, & DeLisi, 1997).

Research Design

The study population was 235 elementary students at the intermediate level from a school district in northern Colorado. One piece of mathematical software was chosen from each of four categories: drill and practice, instructional game, simulation, and tutorial. Students were taught how to use each of the four pieces of mathematics software and then asked to choose their favorite during a free selection time. They recorded both their time on task and the title of the software they chose.

Discussion

The analyses of this study revealed few significant differences for gender and grade level selection of software. However, the individual teacher was found to play a significant role in student choices. These analyses both confirm and dispute prior research on software selection which noted girls prefer drill and practice software, while boys prefer gaming software. The results for time-on-task by gender, grade level and teachers all showed significant differences which also disputes earlier findings.

Software selection by gender, grade level, and teacher variables was a primary focus of this study. Students in this study chose the drill and practice/tutorial mathematics software less often than either the instructional game or simulation mathematics software. The instructional game and simulation mathematics software were both more interactive than the drill and practice/tutorial software and allowed the students to select from a variety of activities within the software. It is possible students in today's classrooms have reached a level of sophistication where traditional software no longer satisfies their needs or expectations.

Girls ($n = 15$) were significantly more likely to use drill and practice/tutorial software than boys ($n = 6$). Studies conducted by Huff & Cooper (1987), Laurel (1998), Malone & Lepper (1980), and Sanders (1995) all found boys are more likely to prefer gaming software than girls. Results from the statistical analysis of this study dispute these former results, as the proportion of girls ($n = 40$) and boys ($n = 43$) who chose instructional game software was not significantly different. Differing results, however, could be due to the fact the software in this study was an instructional game as opposed to a recreational game or perhaps because these students had been taught to use the software during the study. The simulation software used in this study was composed of two distinct sections. The first section asked students to work in stores to solve problems and earn money. Previous studies (Malone & Lepper, 1980; Laurel, 1998) have indicated girls prefer working with problem solving software. The second section of the simulation software allowed students to spend the money they had earned in the shops, playing arcade games. The proportion of girls (n = 45) and boys (n = 53) who chose simulation software was not significantly different. There is a void in the literature concerning student selection of simulation software. It is possible, however, the two very different sections in the simulation software (gaming and task-oriented skills) counterbalanced each other. Had the simulation software not included both sections, results may have differed.

Statistical analyses from this study indicate grade level had no effect on students' selection of mathematics software. The proportion of third, fourth, and fifth grade students who chose a particular type of software differed only by classroom teacher.

Apple Classrooms of Tomorrow (ACOT) research (Sandholtz, Ringstaff & Dwyer, 1994b), as well as work completed by Lohr, Ross and Morrison (1995) indicate the type of instructional delivery in a classroom affects the way students interact with their own learning process. Perhaps the software students selected as their favorite was a reflection of the instructional approaches used by their teacher. Statistical analysis from this study indicates a significant difference between teachers and the type of mathematics software their students selected as their favorite.

This study clearly demonstrated a difference between the time girls and boys spent working with their favorite type of software, with boys consistently spending more time-on-task regardless of software choice than girls did. These results seem to contradict previous findings (Martin, 1991; Murphy & Gipps, 1996) noting boys were more comfortable with computers because they generally had greater access to them at home (Gressard & Loyd, 1987; Mandell & Mandell, 1989; Moe, 1984). All but one student in this study reported having a computer at home and more students reported the primary user of that computer as female rather than male. Although computer use in the home may be a predictor of attitude (Aman, 1992), it does not appear to be a predictor of software selection or time-on-task.

There were significant differences in time-on-task by grade with fourth and fifth grade students consistently spending more time-on-task than third graders. These results are most likely an indication of student maturity level or perhaps a reflection of instructional methods used in their classroom.

While this study did not show significant differences for software selection by gender or grade level, it did show a difference by individual teacher. Further research into the factors underlying these differences is recommended. What methods are these teachers employing in their classrooms that may affect the choices students make when working with software?

Conclusion

Although data from this study indicate no gender significance for software selection, it did illustrate the impact teachers can have on students' time-on-task and software choices. It is important for teachers to be good consumers and evaluators of software like their students. Many teachers have not experienced the technology rich background their students now inhabit. Teachers need instruction on how to seamlessly integrate technology into their classrooms, thoughtfully evaluate software, and be willing to share the responsibility of teaching and learning with their students.

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Why Some African-American Youth's Selves are Driving the Digital Divide

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Abstract: For too long now, we have been attacking the digital divide with a "Field of Dreams" mentality; if we build it they will come. We have tossed money at the divide under the auspice that it will magically disappear if we sprinkle it with the pixie dust of corporate funds and government resources. This paper examines the assumption that the digital divide is not merely about computers, modems, and hardware. Instead the researcher asserts that the key to solving the digital divide is inside the individual users. The paper is the result of qualitative and quantitative research conducted in and around Tuscaloosa, Alabama. The qualitative methodology included interviews, classroom observations, and surveys of African American and European American students in two post-secondary institutions, and a series of technology workshops for middle and high school aged students. This paper is composed of the literature review, as well as the primary theoretical framework behind the research.

Digital Divide

Hoffman and Novak (2000) in their paper, "Bridging the Digital Divide." concluded that European Americans were significantly more likely than African Americans to have a home computer in their households (44.2% vs. 29.0%). European Americans were also more likely to have access to a personal computer at work (38.5% vs. 33.8%), although this difference was not statistically significant (p=.087). In terms of Internet access, European Americans were more likely to have ever used the Web (26% vs. 22%), and the gap between European Americans and African Americans became proportionally larger the more recently the respondents stated they had last used the Web. Further investigation revealed that 12.9% of European Americans vs. only 5.8% of African Americans used the Web 1 week before their survey response date. According to Hoffman and Novak, this roughly translates into 5.2 million (+/- 1.2 million) African Americans and 40.8 million European Americans (+/- 2.1 million) who have ever used the Web, and 1.4 million (+/- .5 million) African Americans and 20.3 million (+/- 1.6 million) European Americans who used the Web in the past week. European Americans and African Americans also differed in terms of where they have ever used the Web. Most notably, European Americans were significantly more likely (14.7% vs. 9%) to have ever used the Web at home. African Americans were more likely to have ever used the Web at school, and European Americans were more likely to have ever used the Web at work and at other locations (such as friends' houses, libraries, etc.), but these differences were not statistically significant (Hoffman & Novak, 2000).

The Divide is Getting Wider

Over the course of the last 10 years, researchers have offered numerous and varied solutions to crossing the digital divide. Voelker (2001) reported that the World Health Organization has joined with a number of public and private partners to improve access to high-quality scientific information for research centers. They are upgrading connections and adding new equipment, and the divide is still widening. The American Library Association (Kranich, 2001) noted that libraries offer not only access to computers and networks, but also the content, training, and expertise crucial to ensure widespread participation in our information society. The ALA has identified equity as a priority action area for the next 5 years and has attempted to articulate how local libraries can ensure equity in the digital age. Yet, the divide continues to grow.

Roach (2000b) cited the conventional approach by non-profit groups and corporations to digital divide initiatives which is to provide computers, Internet access and technology training to people in disadvantaged communities, an approach that has been generally unsuccessful in bridging the divide. Despite all of these warnings, and all of the programs designed to address the digital divide, it is still present. More importantly, headlines tell of a widening gap between upper- and lower-income groups and between single-parent and two-parent families. *Falling through the Net: New Data on the Digital Divide*, a report released in 1998 by the Commerce Department's National Telecommunications and Information Administration (NTIA), noted that although access to communications technology is "soaring," the "digital divide . . . is actually widening over time" and has "turned into a "racial ravine."

There is something seriously wrong with the ways we presently address the digital divide, beyond the fact that they are blatantly ineffective. Perhaps Ramon Harris, executive director of the Executive Leadership Foundation's Technology Transfer Project, was right when he suggested that the digital divide is not about the technology (Roach, 2000). It is possible that Harris was very close to the right answer when he suggested that the digital divide is about access to information as well as placing value on that information.

Social Perceptions of Computers and Computer Users

The truth about technology, at least as far as computers are concerned, is that regardless of how useful they are, their users are consistently viewed in an undesirable light. Computer savvy people are often perceived as, and referred to as "nerds" or "geeks." It happens on the playgrounds, in private conversations, and even among researchers. Coolidge (1998) entitled his article, which investigated high technology companies in the United States looking to teenagers to fill jobs testing software, designing Web sites, and writing computer programs, "Teen geeks ride to tech rescue." Fotheringham's (1999) article on the year 2000 date conversion problem for computers and why the first computer programmers were directly responsible for the magnitude of the problem, was entitled, "Behold the Y2K bug--Revenge of the Nerds and Geeks." Monroy (2000) referred to women who were becoming competent in information technology jobs as "girl geeks." A group of volunteers that taught Java and Unix programming languages in Ghana referred to itself as Geekcorps (Dewan, 2000). Morse (2000) noted that one of the nation's premier computer repair companies is Geeks2Go. Cohen's (2000) article in the New York Times, discussing the Internet as a tool people can use for revenge on another person, referred to such an action as "Revenge among the Nerds." Whitmore (2000) reported that the gatherings of Internet and Information, an association of Internet business pioneers were nothing more than "a gathering of geeks" (p. 38). Koeppel (2000) referred to Silicon Valley in California as the "Valley of the Geeks." There is a defined and definite social perception of computer users. Bill Gates, with his small body frame and large glasses, is the personification of this image. Lohr (2000) even went so far as to suggest that this image problem is the reason for the shortage of computer programmers in the United States.

Research has suggested that negative attitudes and unfavorable perceptions of computers may adversely affect computer literacy (Marcoulides, 1988). Similarly, limited computer experiences were related to computer anxiety and lack of confidence in computer use (Huang, Waxman, & Padron, 1995). This information should be viewed in light of Marriott's and Brant's (1995) assertion that the way cyberspace is marketed to America contributes to negative perceptions by many minority students. They cited the fact that 'surfing the Net' is a foreign language made up of foreign ideas. Most African Americans do not surf. Watson (1996) noted that the "Big Brother is watching you" belief that some African Americans have toward technology also contributed to the negative perception of technology held by many African Americans. Marriott and Brant (1995) agreed with the idea that paranoia plays an important part in the equation. They asserted that computers evoke a deep-seated fear, perhaps even paranoia, among African Americans youth. It is possibly something about the machine's ability to be in every component of your life that scares them (Marriott & Brant, 1995). Many African Americans have said they do not want computers in their homes because they worry those faceless functionaries might use them to spy (Marriott, & Brant, 1995). Finally, Marriott and Brant (1995) contended that young African Americans are the hardest to sell on technology. To them, computers and computer people are the epitome of White nerdiness. Technology is "too much Bill Gates and not enough . . . Bill Bellamy" (p. 62).

Impact of Social Perceptions

Self-concept

The notion of the self-concept extending both backward and forward through time appears in the literature in diverse forms. James (1890) used the term "potential social Me" and distinguished it from the "immediate present Me" and the "Me of the past." Freud (1925) wrote about the "ego ideal," which referred to the child's conception of what the parents consider morally good. For Horney (1950), neurosis occurred when the idealized self became the focus of the individual's thoughts, feelings, and actions. The concept of the "ideal self," the individual's view of "how I should be," was important in the work of Rogers (1951) who claimed that the individual's self-regard depended on the discrepancy between the actual self and the ideal self. The notion of potential selves also intrigued Gergen (1967). He has argued that their range and complexity have been ignored in the focus on the "central tendencies" of the self (p. 64). Similarly, Gordon (1968) analyzed the retrospective, current, and prospective elements of the self, and Schutz (1964) discussed tenses of self, noting the difference between the Present Tense (acts in progress) and the Future Present Tense, which includes anticipated or imagined acts.

More recently, Levinson (1978) has described "the Dream" and has been concerned with the imagined possibilities of the self as motivating forces. The Dream is a personal construction that contains the "imagined self " associated with a variety of goals, aspirations, and values, both conscious and unconscious. With maturation, the Dream becomes cognitively refined and more motivationally powerful. Levinson, however, has focused on dreams; he has not analyzed nightmares or negative possibilities. Similarly, Cummings (1979) wrote of a personally salient "lost dream or hope" that, when reinstated, can serve as a powerful therapeutic procedure to overcome problems such as addiction, negativism, and lack of caring.

Recent reviews of the empirical literature on the self-concept from both the psychological and sociological perspective (e.g., Epstein, 1984; Gecas, 1982; Greenwald & Pratkanis, 1984; Suls, 1982; Zurcher, 1977), reveal that, except for some limited attention to the "ideal self," the content of conceptions of the self, other than those of the current self, have not been emphasized. There have been a variety of efforts to empirically explore individuals' understanding of the future (e.g., Davids & Sidman, 1962; De Volder & Lens, 1982; Goldrich, 1967; Lessing, 1968; Teahan, 1958; Wallace, 1956), but this work has rarely been concerned with how the future is represented in the self-concept.

The link between the future and the self-concept is implicit in the writings of the symbolic interactionists who argue that the self as an organizer of behavior is always anticipating, always oriented to the future (Lindesmith & Strauss, 1956; Stryker, 1980). To Mead (1934), having a self implied the ability to rehearse possible courses of action depending on a reading of the other person's reactions and then being able to calibrate one's subsequent actions accordingly. Whenever individuals engage in this type of role taking, they are in the process of creating potential selves, and there can be as many of these selves as there are times when the self is the object of definition, expectation, or evaluation. Other sociological theorists extended Mead's idea and tackled directly the relation between the self (or identity) and motivation. Foote (1951), for example, believed that all motivation was a consequence of the individual's set of identities. The individual acts to express his or her identity: "Its products are ever-evolving self-conceptions" (p. 17), and "When doubt of identity creeps in, action is paralyzed" (p. 18). When action does manage to proceed with an uncertain identity, it is completely robbed of its meaning.

The self is acquired through social interaction and is a product of particular sociocultural environments (Cooley, 1902; Markus & Cross, 1990; Mead, 1934). The self is viewed as a more or less integrated whole composed of abilities, values, personality attributes, preferences, feeling states, and attitudes (Geertz, 1975; Markus & Kitayama, 1991). A central goal of individuals with this view of the self, termed the "independent self-construal" by Markus and Kitayama (1991), is to "continually identify these attributes and then to insure that they are persistently expressed and affirmed" (Markus, Mullally, & Kitayama, 1997, p. 13).

These attributes, abilities, and preferences are not bound to particular situations or relationships but instead are seen as transcendent and enduring. Although situations may activate different subsets of attributes in the working self-concept (Markus & Kunda, 1986), the core self-representations are assumed to be relatively invariant over time. This belief is reflected in the cultural valuing of consistency across situations. Persons whose behavior varies from one situation to another are very often viewed as waffling, immature, or hypocritical. Because one's attributes and abilities are central to self-definition, people tend to affirm and elaborate those abilities at which they excel relative to others and the attributes that make them appear relatively unique and special. In fact, the self-concepts contain four to five times as many positive attributes as negative ones (Herzog, Franks, Markus & Holmberg, 1994).

Future Possible Selves

Self-concept has revealed the great diversity and complexity of self-knowledge and its importance in regulating behavior (cf. Carver & Scheier, 1982; Gergen, 1967; Greenwald & Pratkanis, 1984; Higgins, 1983; Kihlstrom & Cantor, 1984; McGuire & McGuire, 1982). Until recently, however, one specific domain of self-knowledge has remained relatively unresearched. This domain is commonly referred to as "possible selves." This specific domain of self-knowledge refers to how individuals think about their potential and about their future (Markus & Nurius, 1986). Possible selves are the ideal selves that we desire to become. Possible selves are also the selves we could become, as well as the selves we are afraid of becoming (Markus & Nurius, 1986). The possible selves that are hoped for might include the successful self, the creative self, the rich self, the thin self, the incompetent self, the alcoholic self, the unemployed sled, and the total, complete failure self (Markus & Nurius, 1986).

According to Markus (1986), an individual's repertoire of possible selves can be viewed as the cognitive manifestation of enduring goals, aspirations, motives, fears, and threats. Furthermore, because possible selves provide the specific self-relevant form, meaning, and direction of these dynamics (Markus & Nurius, 1986), they provide the essential link between the self-concept and motivation. The graduate student who fears he will never finish his dissertation carries with him a personalized fear. Furthermore, the graduate student is likely to have a well-defined possible self that represents this fear—the self as having failed, as bitter, as a poet who can't publish her poems.

Possible selves arise from representations of the self in the past and they include representations of the self in the future (Markus & Nurius, 1986). They are different and separable from the now selves, yet they are intimately connected to them. Markus and Nurius pointed out that possible selves are individualized and personalized, but they are distinctly social. For the most part, possible selves are the direct result of previous social comparisons in which the individuals own thoughts, feelings, characteristics, and behaviors have been contrasted to those of salient others. This is where the problem begins for many African Americans. Whereas, an individual is free to create any variety of possible selves, the pool of possible selves derives from the categories made salient by the individual's particular sociocultural and historical context and from the models, images, and symbols provided by the media and by the individual's immediate social experience.

Possible selves, therefore, have the potential to reveal the inventive and constructive nature of the self, but they also reflect the extent to which the self is socially determined and constrained (cf. Elder, 1980; Meyer, 1985; Stryker, 1984). Young African American females who are track participants no doubt absorbed the victories of Marion Jones into their own possible selves. Stories of people dying from the effects of smoking serve to create negative possible selves for smokers. In this same manner, images of savvy computer users as geeks and nerds may create negative possible selves for many youth. This is, however, more detrimental to the possible selves of African Americans in general and African American males in particular, because there are very few positive models to aid in the creation of positive possible selves to combat or counteract these negative possible selves.

It has been suggested that possible selves are important components of motivations, because they function as incentives for future behavior (i.e., they are selves to be approached or avoided), and because they provide an evaluative and interpretive context of the current view of self (Markus & Nurius, 1986).

Markus & Nurius (1986) further contended that the function of possible selves derives from their role in providing a context of additional meaning for the individual's current behavior. Individuals' self-knowledge of what is possible for them to achieve is motivation as it is particularized and individualized; it serves to frame behavior, and to guide its course. In short, possible selves serve to select among future behaviors (i.e., they are selves to be approached or to be avoided).

Self-efficacy

One of the fundamental components of this study is self-efficacy. Self-efficacy theory is an important component of Bandura's (1986) more general social cognitive theory, which suggested that an individual's behavior, environment, and cognitive factors (i.e., outcome expectations and self-efficacy) are all highly interrelated. Bandura (1978a, p. 240) defined self-efficacy as "a judgment of one's ability to execute a particular behavior pattern." Wood and Bandura (1989) expanded upon this definition by suggesting that self-efficacy beliefs form a central role in the regulatory process through which an individual's motivation and performance attainments are governed. Self-efficacy judgments also determine how much effort people will spend on a task and how long they will persist with it. People with strong self-efficacy beliefs exert greater efforts to master a challenge while those with weak self-efficacy beliefs are likely to reduce their efforts or even quit (Bandura & Schunk, 1981; Schunk, 1981; Weinberg, Gould & Jackson, 1979). Efficacy beliefs help determine how much effort people will expend on an activity, how long they will persevere when confronting obstacles, and how resilient they will prove in the face of adverse situations—the higher the sense of efficacy, the greater the effort, persistence, and resilience. Efficacy beliefs also influence individuals' thought patterns and emotional reactions. People with low self-efficacy may believe that things are tougher than they really are, a belief that fosters stress, depression, and a narrow vision of how best to solve a problem. High self-efficacy, on the other hand, helps to create feelings of serenity in approaching difficult tasks and activities. As a result of these influences, self-efficacy beliefs are strong determinants and predictors of the level of accomplishment that individuals finally attain. For these reasons, Bandura (1997) argued that "beliefs of personal efficacy constitute the key factor of human agency" (p. 3).

Self-efficacy theory (Bandura, 1977) suggests that there are four major sources of information used by individuals when forming self-efficacy judgments. In order of strength, the first is performance accomplishments, which refers to personal assessment information that is based on an individual's personal mastery accomplishments (i.e., past experiences with the specific task being investigated). Previous successes raise mastery expectations, while repeated failures lower them (Gist & Mitchell, 1992; Saks, 1995; Silver, Mitchell & Gist, 1995). The second is vicarious experience, which is gained by observing others perform activities successfully. This is often referred to as modeling, and it can generate expectations in observers that they can improve their own performance by learning from what they have observed (Bandura, 1978; Gist & Mitchell, 1992). Social persuasion is the third, and it refers to activities where people are persuaded, via suggestion, into believing that they can cope successfully with specific tasks. Coaching and giving evaluative feedback on performance are common types of social persuasion (Bandura,1977; Bandura & Cervone, 1986). The final source of information is physiological and emotional states.

According to theory and research (Bandura, 1995), individuals with low self-efficacy also have low self-esteem and harbor pessimistic thoughts about their accomplishments and personal development. In terms of thinking, a strong sense of competence facilitates cognitive processes and performance in a variety of settings, including quality of decision-making and academic achievement. When it comes to preparing action, self-related cognitions are a major ingredient of the motivation process. Self-efficacy levels can enhance or impede motivation. People with high self-efficacy choose to perform more challenging tasks (Bandura, 1995). They set higher goals for themselves, and are more apt to persevere in their pursuit of said goals. Actions are pre-shaped in thought, and people anticipate either optimistic or pessimistic scenarios, depending on their degree of self-efficacy. When setbacks occur, they recover more quickly and maintain commitment to their goals. Self-efficacy also allows people to select challenging settings, explore their environments, or create new environments. Researchers (Maddux, 1995; Schwarzer, 1992, 1994) have suggested that a strong sense of personal efficacy is related to higher achievement. This concept applies to such diverse areas as school achievement, career choice, and sociopolitical change. It has become an essential variable in clinical, educational, social, developmental, and personality psychology (Bandura, 1997; Maddux, 1995; Schwarzer, 1992, 1994).

This Research

Attitudes do matter. If African American students are proficient with technology, but do not believe that technology has a use in their lives, or offers a positive future possible self, they will probably not work with technology despite their proficiency. In this respect, attitudes and beliefs about technology serve to "make or break" the cycle of computer avoidance among African Americans in general. On the other hand, African American students who believe in the utility of technology in their lives, and that computers offer a positive future possible self, may persevere through challenges that face novice technology users.

Researchers have investigated the relationship between computer attitudes and computer adoption or uptake (Cox, Rhodes, & Hall, 1988; Davidson & Ritchie, 1994; Kay, 1990). The importance of attitudes and beliefs for learning to use new technologies is widely acknowledged (Bandalos & Benson, 1990; Dupagne & Krendl, 1992; Francis-Pelton & Pelton, 1996).

Several studies have found that individuals' attitudes toward computers might improve as the result of instruction (Kluever, Lain, Hoffman, Green, & Swearingen, 1994; Madsen & Sebastiani, 1987; Woodrow, 1992). In other studies, attitude scales comprised of component subscales were developed. Subscales measured attitudes toward the social issues relating to computer use (Francis & Evans, 1995; Popovich, Hyde, & Zakrajsek, 1987); computer liking, computer confidence, and computer anxiety or comfort (Delcourt & Kinzie, 1993; Loyd & Gressard, 1984b); achievement (Bandalos & Benson, 1990); and usefulness in education, personal usefulness, and value (Francis-Pelton & Pelton, 1996). Like other individual characteristics hypothesized to play a role in the continued growth of technology proficiency, attitudes and beliefs are not easily taught and must be developed by individuals over time.

The driving force behind this study was the slow, yet constant marginalization of African American students based on their "inability" to academically match their European American counterparts. This is particularly alarming when one considers the power of information technology and the generalized demand for Americans to be proficient at this task, if they are to be successful. As a collective group, African American male and female students have scored significantly lower on standardized achievement tests than other populations for far too long. Research suggests that this condition is widespread (Oakes, Gamoran, & Page, 1997; Steele, 1997). African American students are under-represented in programs for gifted and talented students, tend to be over-represented in special education programs and are consistently underrepresented on the honor rolls, which represent academic achievement based on grade point averages. Such observations are consistent with those of Gibbs (1989), Ogbu (1987), and Shapiro et al. (1993) regarding the educational plight of the African American student in our society. These observations are also consistent with those of Harter and Jackson (1992) on effects of intrinsic motivation on academic achievement, learned helplessness (Maier & Seligman, 1976), and the role of protective factors on academic achievement in African American students (Crocker & Major, 1989). Therefore, it is possible that motivational variables may influence African American students' computer usage differently than European American students. If these motivational variables and their effects can be determined for African American students, then it may be possible to develop instructional strategies to improve the integration of computers into their lives, and begin to use the technology as the powerful information tool it is.

Using Technology to Encourage Motivation and Achievement in Academically At-Risk Secondary Students

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Abstract: This paper reports research efforts to establish how successful use of technology relates to achievement and motivation of at-risk secondary school students; and to identify aspects of technology use that appear to have a positive effect on these students' learning outcomes. Using school records, academically at-risk students were identified in one middle school situated in a mid-western city. These students were interviewed and observed in technology classes. Interviews were also conducted with the technology teacher concerning how the curriculum was designed and taught. Initial findings in this study, were inconclusive. In anticipation that a larger number of participants will begin to reveal categories and patterns of responses, data from a group of high school students will be included with existing data. It is hoped that eventually results from research such as this will help teacher educators better prepare pre-service teachers to choose effective technology teaching strategies and to integrate them into their classrooms.

Introduction

It is generally believed that the wise use of technology in teaching can lead to enhanced student motivation and achievement (Becker 2000; Chen & Looi 1999; Mistler-Jackson & Songer 2000). One reason that the use of technology can increase the learning achievement of students has to do with the very nature of technology (Kozma & Croninger 1992). Cognitive psychology suggests that learning is an active process in which the learner uses existing cognitive resources to construct new understanding from information provided by the environment and knowledge from prior experiences stored in long-term memory. Obviously, then prior knowledge has a major impact on current learning. Knowledge is best remembered when it is stored both as a mental image as well as a verbal description (Paivio 1990). Technology is complementary to cognitive learning in that it provides the means by which visual and verbal representations can be constructed and can model or perform certain processes such as problem solving that facilitate successful learning (Salomon 1988).

The literature provides numerous examples of improving the retention rate of at-risk secondary students as well as enhancing motivation through the use of technology (Chen & Looi 1999; Gan, 1999; Mistler-Jackson & Songer, 2000; Wishart & Blease, 1999). In part, technology is motivating because it is a hands-on approach that allows students to take charge of their own learning (Candon 2000, Taylor-Dunlop & Norton 1997). Not only did technology motivate at-risk students to learn when they were at school, it was also a major reason that at-risk students came to school due largely to the kinesthetic nature of interactions with technology (Taylor-Dunlop & Norton 1997). Dewey (1900) proposed that the use of hands-on activities provided intellectual stimulation for students that in turn increased learning. Considering Dewey's theory in an educational technology perspective, Herschback (1998) observed that technology demands of students an interaction with the learning environment and therefore was useful "in designing integrative and higher-order learning" (p. 55).

However, simply using technology in the classroom does not automatically result in improved learning and teaching (Mecklenburger 1990). To be truly effective, technology integration into classroom practice must recognize students' abilities, needs, and learning styles as well as the content structure of the discipline (Dunn, Dunn, & Price 1989). Additionally, the Laboratory of Comparative Human Cognition (1989) suggested that technology use with at-risk students is more effective when it is used in conjunction with collaborative groups of students with a well defined learning goal; involves complex simulations that require higher-order thinking; and connects students with their family, community and other cultures.

Background

When the National Educational Technology Standards (NETS) were incorporated into the program goals of the undergraduate teacher preparation program at Wichita State University, teacher educators began to examine effective uses of the integration of technology into classroom practice. Faculty worked in teams across four semesters to describe ways in which technology was currently being used in the program and to look for additional ways to effectively integrate technology into the various program courses.

The undergraduate teacher preparation program has a strong field component in all semesters of the program. Over forty public schools in the city school district provide field placements for students in the teacher preparation program. This gave rise to the opportunity for informal discussions with teachers in the field regarding their beliefs about the link between the use of technology and learner motivation. These discussions revealed that in-service teachers too were seeking possible ways in which they could effectively integrate technology into their existing curriculum to better facilitate successful learning.

Further these classroom teachers pointed out that they had become aware of a number of students who were only making a passing grade in their technology class while failing all of their other classes. They wondered if there was a connection between technology usage in the classroom and an increased level of student motivation to learn. These observations led to the question, "What types of technology integration most effectively encourage and motivate students to learn and achieve?" Answers to this question can help pre-service teachers, teacher educators, and classroom practitioners to provide a more responsive learning environment for all learners. The informed technology integration decisions of practicing teachers ultimately enhance all students' learning experiences and increase positive student outcomes (Kauchak & Eggen 1998). Teachers need to know what factors of technology use are crucial for consideration as they develop curriculum delivered at least in part through technology. This research sought to establish how successful use of technology relates to achievement and motivation of at-risk secondary school students; and to identify aspects of technology use that appear to have a positive effect on these students' learning outcomes.

Method

For the purposes of this study, at-risk students were those who did well in technology classes but who were receiving Ds or Fs in all or most other classes. The technology teacher using school transcripts identified a list of possible participants. The parents of these students were sent a letter explaining the research and a consent form to return should they wish for their child to participate. A total of 12 of the 16 possible participants returned consent forms and therefore, were included in the study.

An interview schedule was developed for use with the students that consisted of eight questions. Additionally, probe questions were written for five of the eight questions. The interviews were conducted in the technology classroom during class time. One researcher asked the interview questions while the other recorded responses. Interviews were also taped to insure accuracy and thoroughness of recorded responses. Most (9) of the students were interviewed during their technology class, however, three were given permission to come for the interview during another class. Once students were interviewed, they were observed working in the technology class. The two observers informally discussed the student's technology project with him/her, which helped to verify the student's responses to the interview questions. Informal interviews were also conducted with the school administrator and the technology teacher.

Individual student interviews, observation data, and the administrator and teacher interviews were coded using the constant comparative method (Maykut & Morehouse 1994) to establish themes, categories, and issues across the data. Additionally, the two researchers and a research assistant independently coded the data and then discussed the data, coding and recoding it until 100% agreement was reached. Through the multiple types of data gathered and researcher agreement, triangulation of the data was obtained and reliability established.

Findings

This paper reports the data results and findings concerned with the student interviews. The schedule of interview questions was constructed guided by the researchers' assumptions that technology was motivating a) because of its novelty, b) because the class was organized in a more appealing way for the learners than were other academic courses, and c) because technology activities required less reading and writing for completion of class assignments.

Responses regarding access to computers and the Internet other than at school did not support the researchers' assumption that access to technology was only available at school during technology class and therefore was motivating because it was a uncommon activity. Of the twelve student interviewees, eleven (92%) reported that they had regular access at home (n=10) or at a parent's place of employment (n=1).

The students used the Internet for a variety of activities. The most common use was playing games (n=8, 67%) followed by sending and receiving of email (n=7, 58%). Other Internet activities included research (n=6, 50%), school projects (n=5, 42%), general information searches (n=5, 42%), presentations (n=2, 17%), chat rooms and making birthday cards (n=2, 17%). Students also reported using a total of 10 different applications and software packages including Word, Excel, Adobe Acrobat, Word Perfect, Photo Shop, Paint, Clip Art, Print Master, PowerPoint, and Grolier's Encyclopedia.

When interviewees were asked what they liked about using technology, eight (75%) of the students answered that they enjoyed searching for and learning new information. One student liked "accidentally finding new information on the Internet. There were six students (50%) who responded that they liked the ability to do artwork and other creative things using technology. Responses from six students (50%) also identified the ease of using technology was one thing they liked. Comments such as "It's easy to correct", "I don't have to write", "It's faster", "I can make what I want (so it)...looks professional", and "easy to get information faster" were included in the 'ease of use' category.

Responses to a question asking what the interviewee liked about technology class indicated that for several of the students (n=2, 17%) the organization of the class was important especially in terms of self-directedness. Types of responses included in this category were "I can talk with other people", "I get to do more on my own", and "There's just more freedom in our technology class". Two other students (17%) described teacher characteristics of "nice" and "willing to help" as what they liked about their technology class. However, the largest number of students (8, 75%) gave responses concerned with the type of content that was learned in the technology class and indicated that was what they liked about their class. These students enjoyed "the opportunity to learn", "work(ing) on a web page", "learning to insert pictures...into documents", and finding "new stuff ... like new links and graphics".

The students were also asked if they worked with other students during the technology class. The researchers anticipated that group work might be appealing to the at-risk students. Initial responses do appear to support this assumption. Eight students (75%) reported that they frequently worked with others on projects and seven students (58%) said that they helped other students even if they were not working on the same project. Only three (25%) of the students said that they did not work with or talk with other students.

Interviewees were asked several questions pertaining to the amount of reading and writing required in the technology class because the researchers believed that less use of reading and writing skills would be motivating to the at-risk secondary students. However, a total of seven students (58%) responded that there was "a lot more" reading in the technology class (n=6, 50%) or that there was "more (reading) than (in) other classes" (n=1, 8%). Three students (25%) answered that the amount of reading required was the same as other classes while only two (17%) responded that there was less reading involved in their technology class than there was in other classes. When asked how much writing was required in their technology class, four (33%) said more was required than in other classes, four (33%) said less, and two (17%) said it was the same amount of writing in all of their classes. Two (17%) of the students were undecided.

To conclude the interview, the student interviewees were asked why they thought they did better in technology class than in some of their other classes. Seven (58%) believed that it was partly due to the fact that their technology class was easier for them than other classes; while 3 (25%) of the interviewees said they did well in technology class because they found it interesting. One student said he thought he did better because "other classes (were) too easy" but technology class was challenging. Two students said they were not sure why they did better.

Conclusions

The initial findings of this study showed that all of the at-risk students who participated in the research, used technology at home and at school on a regular basis for playing games, emailing, completing various type of school assignments, participating in chat rooms and making birthday cards. They had a substantial knowledge of a variety of applications and software. Most of the students (n=8, 75%) enjoyed searching for and learning new information while the same number enjoyed the skills that they learned in their technology class such as constructing a web page, activating external links, inserting pictures, and designing graphics. Most of the students (n=8, 75%) enjoyed the opportunity to work with other students on projects in their technology class. It was found that for these at-risk students the amount of reading and writing required in their technology class was not a factor that influenced their motivation when working with technology. Finally, a majority of the at-risk students believed that they did well in technology class because they either found the work easy (n=7, 58%) or interesting (n=3, 25%).

These findings, though not conclusive, do suggest that technology can motivate at-risk secondary students to achieve when the learning environment allows group work, when the content is perceived by the students as easy to learn and when the students view the content as relevant and interesting. It is anticipated that additional interviews with at-risk secondary students will help to clarify and validate these initial findings.

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Process of teacher's buy in and Web design project adopting constructivist model

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Abstract

Current education is facing the challenges of the high standards which the 21st century demands. The new standards emphasize the importance of technology integration as a catalyst for instructional change. Technology integration may offer an active, meaningful, and authentic learning environment for engaging students more in the learning process, and encouraging student ownership of their learning, which are essential parts of the new standards. The need for competent, well-prepared, talented and dedicated teachers in every classroom has been described as the major key to effective technology integration.

Consistent with technology use as the catalyst for instructional change, a paradigm shift from traditional teaching and learning to a constructivist model is critical to accomplish society's expectations for education. Learning through a Web based design project would be one way of facilitating an authentic learning environment, which includes mastery of basics, inquiry, collaboration, and responsibility as the hallmarks of effective education.

One particular component in the new standards has focused on teachers' pedagogical beliefs and practices related to technology integration into teaching and learning. The new standards demand a paradigm shift in teaching and learning with technology, and challenge many teachers to modify, transform, and even abandon their traditional model of teaching and learning into an unfamiliar new model to accomplish these expectations. The process of change in teacher's pedagogical beliefs and practices is often a painful and difficult one, causing teachers a good deal of stress. Teacher educators need to know more about this process to be able to help teachers make the shift smoothly.

In the constructivist view, widely accepted as a legitimate pedagogy, teaching is considered as a "process of helping learners to construct their own meaning from the experiences they have by providing the opportunity for those experiences and guiding the meaning-making process" (Jonassen, Peck, and Wilson, 1999). Teachers must construct their *own* understanding of this theory and need to design effective and meaningful teaching methods to implement this theory into practice.

An authentic learning environment which is designed to make a connection between meaningful learning and the socially interactive community, is vital to fulfill societal expectations for educational. The environment is the adoption of a constructivist pedagogical approach in a collaborative culture. This might be accomplished within a Web-based curriculum, for example. Such rich learning environments would provide opportunities for learning activities in which "students are engaged in a continuous collaborative process of building and reshaping understanding as a natural consequence of their experience and interaction with the world" (Dunlap and Grabinger, 1996).

Although technology integration and a constructivist approach to teaching and learning hold the promise of promoting meaningful learning in a rich-context learning environment, teachers often have difficulties adopting a new way of teaching, and in changing their pedagogical beliefs and perceptions. These difficulties may not result simply from teachers' lack of familiarity with combining computer technology and a constructivist approach, but rather may be a result of their failure to recognize a new way of thinking and designing. In the process of applying constructivist concepts, teachers need support and encouragement from educational leaders, researchers, and teacher educators to help them refine their methods and change their teaching practices consistent with a constructivist approach. The process requires that teachers invest more time, effort, and even struggle to cope with conflicts and barriers in their school environments.

Teachers' changes in instructional approach are the result of a thoughtful process, which is their construction of knowledge about what 'works' and doesn't work in the classroom. It is cautioned that technology integration is not just a matter of "plug and play" from others' work, and that "tweaking" someone else's idea isn't nearly as satisfying, nor effective working out your own ideas for your own classroom. The concept of teachers designing their own activity and curriculum, responding to the dynamic and unique conditions of their classrooms, would be more in keeping with a constructivist classroom.

Therefore, instead of being passive borrowers, teachers need to "buy in" (Perkins, 1991), to become active designers.

The research examined the process of change in teachers' pedagogical beliefs and practices doing Web based design project and how they struggle and triump h in creating new strategies. This study employed a qualitative research design, using descriptive case study methodology. The teacher participant in this study was a teacher who was engaged in her second project in which her students were designing Web-based projects in order to learn and communicate about a subject matter. Her students designed authentic Web-based projects in which they became technology leaders in the school and the school district, helping the teachers and other students.

This study intended to describe one teacher's understanding and pedagogical beliefs toward seeking to use a constructivist model of teaching and learning, and the process of change in that direction, and doing so in the context of the teacher's designing Web-based projects with her students. This study described a teacher's pedagogical beliefs and perceptions before and after having her students do a constructivist technology project, in order to understand how these beliefs have changed. The research also focused on understanding the effects of constructivist design on teacher's teaching strategies and constructing pedagogical beliefs. The purpose was to find ways of helping teachers to "buy in" (Perkins, 1991) to becoming an active designer rather than being a "plug and play" (Harris, 1998), passive direction-follower.

The research provides implementation, which enable teacher preparation institutions to better prepare preservice and inservice teachers for active design of buying in constructivist model of teaching which integrates technology.

A Multilevel Analysis of the Relationship between School and Teacher Variables and Students' Usage of Technology

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Abstract: The purpose of this study was to determine the impact of teacher and school variables on students' usage of computer technology in elementary schools. Participants in the study were 10 classroom teachers and 219 fourth- and fifth-grade students representing rural, urban, and suburban in the Northeastern region of Ohio. The findings in the study show that, teaching experience, teachers' attitudes towards technology, and their school's technological environment were significant predictors of the students' adjusted classroom average technology usage. Teaching experience and teachers' attitudes towards technology had a positive relationship with students' technology usage.

Over the past two decades, there have been significant increases in the use of technology and in access to computer technologies in schools. However, there are important questions of students' competence in necessary technological skills. If students are expected to develop technological fluency for their learning, their teachers must also possess this fluency. If some teachers neglect to use technology in their teaching or to teach the second-level skills of knowledge integration for deeper understanding, students may not be equally prepared to become knowledge workers functioning at higher levels in society.

Many studies investigated students' usage of technology underscore teachers' role in integrating technology. A study about educators' beliefs and technology-related activities revealed that teachers who used e-mail at home, used Internet in classrooms felt technology improved their teaching roles (Norris, Soloway, Knezek, Topp, Young, & Box, 2000). Parr (1998) emphasizes that the beliefs of students and teachers influence the use of technology in their classroom and that the learning context with technology is co-constructed by teachers and learners. Mills (1999) stresses that a successful integration of computer technology in instruction must be approved, accepted, and implemented by teachers. Honey and Moeller (1990) indicate that teachers' educational beliefs play an important role in integrating technology into the curriculum. The purpose of this study was to determine the impact of teacher and school variables on students' usage of computer technology in elementary schools.

Methods

Participants in the study were 10 classroom teachers and 219 fourth- and fifth-grade students representing rural, urban, and suburban in the Northeastern region of Ohio. The subjects were identified to be in two levels of an organizational hierarchy. At the level-1, a short survey is being administered to fourth and fifth grade students to assess their technology-related learning environments and their level of usage of technology such as word processing, drawing, presentation, spreadsheets, keyboarding, game, reading software, encyclopedia, web searching, e-mail, etc. At the level-2, a survey was administered to 10 classroom teachers whose students (level-1) participated in the study. The teachers' questionnaire was designed to assess teachers' technological beliefs, practices and demographic characteristics such as accessibility to computers at home and in the classroom, technological training, gender, teaching experience, and area of teaching.

Students' responses to the survey items were internally consistent with a Cronbach's Alpha reliability coefficient of 0.84. A combined scale of *technology usage*, created from these eleven items was utilized as the primary outcome variable of the study. Teachers' attitudes toward technology, their perceptions on school technological environment, as well as their usage of technology was used as the primary independent variables of the study. Due to the fact that students are nested within teachers (or classrooms), hierarchical linear model (Bryk & Raudenbush, 1992) was best suited for data analysis of the study.

Results

Table 1 presents the teacher-level model (level-2) results for the prediction of students' technology usage by school contextual and teacher variables. At this level, the outcome variable is the students' adjusted classroom average usage since the students level variables were grand mean centered at the student-level (level-1) model.

Variable	Coefficient	t-value	p-value
Teaching experience	0.22	4.12	0.012*
School location (1=urban, 0=non-urban)	0.22	1.46	0.203
Teacher's attitudes towards technology	0.74	3.78	0.018*
School technological environment	-0.59	-3.74	0.019*

Table 1: Teacher-level model results for the prediction of students' technology usage by school contextual and teacher practice variables; * $p < 0.05$

The findings in Table 1 show that, teaching experience ($\beta = 0.22$, $p < 0.05$), teachers' attitudes towards technology ($\beta = 0.74$, $p < 0.05$), and their school's technological environment ($\beta = -0.59$, $p < 0.05$) were significant predictors of the students' adjusted classroom average technology usage. Teaching experience and teachers' attitudes towards technology had a significant positive relationship with students' technology usage. Surprisingly school's technological environment had a significant negative relationship with students' technology usage.

Conclusions

The findings in the study may suggest that, teachers' attitudes towards technology are more important in enhancing their students' technology usage than school technology environment. A possible explanation for the negative relationship between school's technological environment and students' technology usage may be due to varying teachers' expectations. It is possible that teachers who utilize technology more have a higher level of expectation on their school's technological support and resources. Contrary to other studies which have shown a negative relationship between teaching experience and technology use, the sample of teachers who participated in the study varied only minimally in their teaching experience, from two to eight years.

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Deepening the Impact of Technology through an Inquiry Approach to Teaching and Learning: A Cross-Case Analysis of Three Teachers' Experience

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INTRODUCTION

Teachers know that in order for students to learn they have to be engaged in the learning process and preferably interested in the topic. Robert Fried takes this a step further as he highlights the need for both teachers and students to become passionate about their learning (2001). This study focuses on three teacher professionals whose teaching practices capitalize on the use of multiple technologies and inquiry method as a means to deepen student learning, engagement, and understanding. Though there are many exhortations to use inquiry to stimulate thinking and learning, it is more easily said than done, given teacher educational models and pressure on teachers to increase student achievement on standardized tests.

PURPOSE OF THE STUDY

The term "inquiry" encompasses many meanings (Short & Burke, 1996) and can have confusing and negative connotations for teachers. Although commonly associated with science education (Ben-Chaim, Ron, & Zoller, 2000; Pierce, 2001), inquiry can be used with any curricular area. This study provides a window into the experiences of three veteran teachers who use inquiry in a classroom equipped with multiple technologies. This study reveals how teachers who ascribe to the inquiry method use technology to support inquiry and learning, and reveals the benefits (and drawbacks) of incorporating inquiry and technology in the classroom. The goal of this study is to determine the differences and similarities in teachers' beliefs and strategies about incorporating inquiry and technology. Through a cross–case analysis, we will be able to see a broader range of understanding about the use of technology to support inquiry, and the findings can present models of use that other teachers can reflect upon as they think about their own teaching and technology infusion.

BACKGROUND

The Ameritech Electronic Classroom (AEC), a unique research facility at Kent State University and part of the Research Center for Educational Technology (RCET), has been in operation since spring, 1998. One strand of the research focus of RCET is: "Under what conditions can technology be used by students for problem solving, inquiry, and critical thinking, and what are the impacts of such use on student learning? " (RCET, 2000). This question was the impetus for this study.

Area teachers and students call the AEC "school" half a day, every day, for a six-week period. Teachers bring their own units, and are supported by an administrative specialist, instructional specialist and technology specialist during the time they come to the AEC. Teachers who come to the Ameritech Electronic Classroom are identified through a selection process which involves being nominated by their principal. The teachers then participate in a one-week orientation that focuses on the inquiry method supported by a variety of technology.

During the one-week orientation, teachers read about and discussed the issues involved in creating authentic work for students (Newmann & Others, 1996). They created guiding questions as the backbone of their inquiry units (Traver, 1998), and discussed how to design units that involve students in the development of questions that guide their own learning (Short & Burke, 1991). This professional collaboration was continued throughout the year with periodic meetings to discuss topics about teaching with inquiry and technology, and to share unit plans and ideas as "works in progress". These meetings were set for one time per month for the first year and changed to quarterly for the second year with online communication and support available.

PARTICIPANTS

The participants in this study were two fourth grade teachers, and one eighth grade teacher from area schools. Nancy*, a fourth grade teacher, who has taught for 11 years, chose a unit on conflict. Sarah, another fourth grade teacher, who has taught for 15 years, chose to continue a unit on immigration that she had begun at the first of the year. Robert, an eighth grade teacher, who has taught for 28 years, focused on oral histories. All units were interdisciplinary, incorporating mostly social studies and language arts as the target curricular areas.

METHODOLOGY

The following methodology was used for each case. In order to assure validity of the data, multiple data sources have been used in this study. Teachers were interviewed after their one-week orientation during the summer, just prior to their turn in the Ameritech Electronic Classroom. They were interviewed once a week with a semi-structured format that allowed us to tailor some questions to issues that emerged from the prior week's interview and observations. All teachers were observed two times a week in the Ameritech Electronic Classroom and once per week in their home school classroom. This allowed us to see differences between their strategies and orientation to teaching within and outside of the technology immersed environment. All three teachers had technology in their home school classrooms to some degree. A teacher reflection journal was recorded weekly, and unit and lesson plans provided a final data source.

DATA ANALYSIS

The rubric for authentic and intellectually engaged learning (Newmann, Secada, & Wehlage, 1995) will be used to code the data with the software, Ethnograph. Instances of use of technology will be noted, as well as teachers' rationale for using technology, and how they believe it supports student learning. These responses will then be coded for patterns. Categories that emerged will be analyzed to develop a framework of each teacher's understanding and mental model of the concept of inquiry, how the teacher believes it enriches student learning, and how technology supports teacher and student inquiry in the classroom. These individual cases will then be compared and contrasted.

CONCLUSION

The results of this study will create a picture of how teachers use technology to support inquiry. Our experience with teachers, such as those in this study, shows that they are committed to engaging their students in learning through a multitude of means. Learning, to these teachers, is about delving deeply and broadly into topics that they believe are relevant not just to them as educators, but also of interest to their students. They also know the importance of aligning all learning to state standards and to the objectives of state level standardized tests. This is not an easy tightrope to walk. Even with years of experience in the classroom, these teachers express the difficulty of the balancing act they willingly walk every day. Capturing these teachers' experiences and reflections can provide an important window into how expert teachers maintain their passion for learning by embracing both inquiry and technology use to deepen the impact of student authentic learning.

[This study is in its final weeks of data gathering. As such, the data analysis has not been completed.
Project Completion Timeline:

- November, 2001 – Data collection completed
- November, 2001 - January, 2002 – Data analyzed and results compiled
- February, 2002 – Study write-up completed]

* Teachers names were changes for confidentiality purposes.

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Teaching Activities Through the Internet & a Study in Anadolu University

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Abstract: Internet, which has entered into our daily life with the rapid changes in data processing, has brought many developments into the educational area through easy access to the information and rapid communication services for users. The use of Internet in training environment has been providing new educational opportunities especially for adults in addition to their main education. Teaching activities through the Internet, which remove the physical handicaps such as time and place, enable the individuals to continue their education within their professions. Teaching activities through the Internet for various purposes have been organized by institutions which gradually rising in number over the world.

Introduction

Obtaining data in great amounts, easy accessing to information and rich communication possibilities of Internet has formed the idea of Internet for teaching purpose, and this has pioneered the formation of the "teaching activities through the Internet" concept. There are various definitions for teaching through Internet in literature. Khan (1997) defined the "Teaching Through Internet" as a teaching program to form a meaningful teaching environment which will increase and support learning by using the features of the Web and which is supported by computer technology. On the other hand, Relan and Gillami (1997) defined "Teaching Through Internet" as "to create formal and co operational learning environments by using the features and possibilities of WWW, by applying educational strategies to teaching environment" (Henke, 1997, p:1). These definitions for teaching through Internet state that since Internet includes the accessing to information, synchronous and asynchronous communication services, it enriches the teaching environments, supports learning based on cooperation, makes it easier for students to evaluate themselves and for instructors to evaluate the students.

There are various types of use of Internet, which means the use of Internet for the purpose of teaching and it is possible to group the teaching activities through Internet into four groups (Senis, Mutlu & Çetinöz, 1999).

- Providing Internet support for Structural lessons
- Internet based presentation of structural lessons
- Application of virtual University
- Internet based certificate programs

Teaching activities are increasing rapidly through Internet, which can be used in different ways in teaching environments, depending on this, more students in number can continue their educations using these programs free from the place and the time.

Purpose

Main purpose of this study is to examine teaching activities through Internet and to analyze effectiveness of these mentioned applications. As for the aim, the first two units titled as "Introduction to Information Technologies" and "Algorithm Concept and its Fundamental Features" of "Fundamentals of Information Technology" course which is given in order to make the students in all Faculties, Institutions and Vocational Schools using structural education in Anadolu University to gain computer-literacy and which is for one term course was designed as an Internet teaching activity by using WebCT and the success of the students taking this course was determined by using two different Teaching Activities Through Internet (Internet Supported Teaching and Internet Based Teaching) and traditional teaching activity within the presentation of the content.

Methodology

As for the aim, a model with pre-test and post-test control groups was applied in the study. 71 subjects from 2000-2001 Academic Year Spring term students of "Fundamentals of Information Technology" in Anadolu University participated into the study. First of all the content was converted into teaching activities through Internet by using WebCT and then in order to examine the students' success pre-test and post-test which were consisted of the units that were mentioned was given to the students by the researcher. A subject-success test was applied as a validity and reliability study before the research was conducted. The subject-success test was given as a pre-test to the groups before the units that were mentioned were followed. The first group used "the Internet-Supported Instruction" as teaching activities in the "Fundamentals of Information Technology" whereas the second group was trained by using "the Internet-Based Instruction" in the same course. The last one was the traditional group, which the Internet was not used. At the end of the study, thepre-test was given as the post-test.

Findings and Comments

To analyze the data and its comments, first of all the scores of the pre-test and post-test applications of the experimental and control groups were gained and then each students' arithmetic average pre-test scores were examined to find out whether there was a significant difference between the scores by using one-way ANOVA analysis. Among the arithmetic average of pre-test and post-test scores of the students in each three groups, it was defined that there was a significant difference in the advantage of the post-test. In order to define the direction of the significant difference in post-tests one of the multiple comparison tests, Tukey's Honestly Significant Difference Test (Tukey's HSD test) was used. Table 1 demonstrates the findings gained in the study.

Experimental Groups	Experimental Group I	Control Group
Experimental Group II	15.79*	15.57*

*P<0.05

Table 1. Tukey's HSD Test Findings of the post-test scores of the Groups

According to the results of the study, first of all, it was defined that there is a significant difference in the advantage of first experimental group in which Internet Supported Instruction was applied. Additionally, it was found that there is also a significant difference in the advantage of the control group in which the traditional teaching instruction was applied.

Secondly, it was defined that there is a significant difference in the advantage of the control group in which traditional teaching instruction was applied. This finding shows that there is a significant difference in the students' success level in both traditional teaching instruction group and Internet supported instruction group in the advantage of the first group.

Conclusion

The main findings of this study are:

1) ***The teaching activities of Internet-Supported Instruction*** are more effective on students' success in "Fundamentals of Information Technology" course than ***the teaching activities of Internet-Based Instruction.***
2) ***The teaching activities of which the Internet is not used*** are more effective on students' success in "Fundamentals of Information Technology" course than ***the teaching activities of Internet-Based Instruction.***

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Using Information Visualization To Enable Teachers To Search And Teach With The Internet

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Introduction

Historically, issues such as the retrieval of information have been the problem of Librarians and information scientists and only of ancillary interest to educators. However, we need to consider that current government estimates show that more than 95% of American K-12 schools and virtually all institutions of higher learning are connected to the Internet (National Center for Education Statistics 2000). Indeed, billions of dollars have been spent to provide the infrastructure and equipment to achieve this.

Now that we have all these schools wired it remains to be seen what we are going to do with the Internet. There are many pedagogically sound uses of the Internet and certainly one of them is access to information from around the world. Ultimately, most educators would like to see a day when students can access the limitless collection of media on the Internet and find many relevant resources related to their topic of study. Clearly, the seemingly boundless trove of information, art, music, literature and other forms of media on the Internet is one of its greatest potentials. Information and media that in the past might have been available to only a few, can now be accessed by the many. However, anyone who has tried to find quality information on the Internet, realizes that this is often difficult (Jansen, Spink et al. 1998; Silverstein, Henzinger et al. 1999). This is backed up with personal conversations I've had with teachers, where the most common complaint heard is "I know there is a lot of good 'stuff' on the Internet but, I just don't have time to find it." Yet in spite of the difficulties associated with finding information, students are being called upon to learn from distributed sources of information on the Internet. As many as 30% of K-12 teachers have reported that they required students to find materials on the Web to a large or moderate extent (National Center for Education Statistics 2000). To address this issue in the past there have been many efforts to build static, manually maintained, domain and grade level specific collections of "good" pages. Unfortunately, these repositories are difficult to sustainable. What is needed are new methods of finding information, learning from it once it is found, and sharing that information with other teachers and students.

Let's be clear here, the problems we have with finding information on the Internet are not unique only to teachers and is not "just" a training issue for them. Finding and learning from information on the Internet is problematic for teachers, those preparing to become teachers, students, and anyone else desiring to learn from information found on the Internet. To overcome the problems in searching the Internet many advocate teaching better search skills that ultimately rest on the searchers' cognitive abilities to formulate a query, filter information, assess validity, organize results, and generally make sense of what can be a very ill-structured task. Yet cognitive abilities have obvious limits, and mastering search skills takes time on task that many searchers do not have to master often complex query languages that vary from search engine to search engine (Jansen, Spink et al. 1998). Research on information retrieval shows that most well formulated queries involve seven to fifteen search terms and relatively sophisticated query logic (Meadow 1992; Korfhage 1997) yet, the average number of search terms in a Web query is somewhere between 2 and 2.5 words (Silverstein, Henzinger et al. 1999). Furthermore, less than 5% of all Web searches use Boolean operators and of those that do, it's estimated that as many as 50% may be using them incorrectly (Silverstein, Henzinger et al. 1999).

When and if information can be found, the teacher must do something with it to make the in formation available to students and, students must now "do something" with it to construct knowledge. Current search engine interfaces do little if anything to support the knowledge construction process. Studies I am currently conducting indicate that most students (undergraduate students in education, most of whom are preparing to become teachers) use a variety of strategies for selecting Internet sites and learning from them. Often however, they pick the "first" site that appears on the search results or those with a "catchy title." This sadly strikes me as reminiscent of a trip to the library where students pull the first book off the shelf (more often than not the encyclopedia) that seems to have any information on their topic and commence to write a paper. If we are to fully utilize the Internet, we need to prepare teachers and, help teachers prepare students, to find and learn from information on the Internet. Better skills and tools are needed to find and learn from information, better methods for dissemination of information once it is found and organized into meaningful structures, and better ways to maintain repositories of information for use by teachers and students.

Imagine for a moment, a high school history teacher who does a search for "World War II". They are presented with a list of perhaps hundreds of thousands of "hits" from which they have to find the "good" sites. If the teacher uses one of the more popular search engines they will get pages from a sampling from about 16% -30% of the Web and, the validity of these pages is indicated solely by the search engine or index's relevancy ratings which is highly questionable (Spink and Greisdorf 2000). The teacher must then sort through the hits, determine which ones are good, browse through the sites for other related pages and perhaps they will click through to other sites not returned by the search engine. If this raw information is to be used to prepare a unit on World War II, something must be done with it to make it useful. If the teacher chooses, and knows how, they may be able to make a html list of the sites they found in a hierarchical order for dissemination to other teachers or their students. But, this all requires a good deal of work, lacks the means for easy dissemination and furthermore, the links collected are subject to "link rot". Without constant checking, over a relatively short period of time, many of the links found will be broken.

Alternatively, imagine that the same teacher could search the Web with multiple search engines simultaneously and manipulate the hits in such a way that information about Normandy could be placed on the appropriate location on a world map by simply dragging an icon that represents the Web page. Information about Germany's eastern front could be placed in Russia and information about the Burma Road could be located along the actual route. Instead of printing pages the teacher could easily cut and paste information from the page or make notes that would pop-up whenever a mouse was place over the icon that represents the Web page on the map. When the page icons are clicked on, the entire page could be displayed in a browser for more information. Irrelevant hits could be deleted and new sites that are found while browsing could be easily added to the map. If the entire "search space" information could be saved, map, notes and all, it would be very easy for the teacher, colleagues or students to access the information to use for their own purposes. Such search spaces could be easily made available to other and they could even be collaboratively constructed. Let us further imagine that all who use this search space implicitly contribute to keeping the links updated, help find new links of interest and adjust the relevancy weightings for sites showing similar information simply by using the search space for their own purposes. Over time, data could be collected that would shed light on other dimensions as well. Such as which sites are best suited for a high school teacher vs. a university researcher. Perhaps patterns could be detected that would allow detection of "misinformation" put out by groups pushing particular perspectives (e.g. groups that advocate there was no holocaust). Or, perhaps patterns that highlight women's perspectives or a particular countries involvement in the war could be highlighted. Through normal searching and learning activities, a repository of search spaces, or knowledge structures could be built, maintained and modified simply by users searching the Internet for their own purposes.

Our Approach

We have developed a graphical user interface that applies visualization to Internet search results. Instead of lengthy lists of search results, the Visualization of Information Tool (VisIT) presents the user with a graphical, spatial representation of the search space where each Web site is represented and all of the hits returned are clustered within that site representation. Now the user can "see" the hits returned by the search engine and other pages at the site and, when any of the pages are clicked the appropriate page is displayed in the browser window (Figure 1.). Searchers query multiple search engines simultaneously to construct a search space and, heuristic based rules augment search engine relevancy rankings. Upon placing the cursor over any page, a pop-up box appears with search engine comments (if any) and the first 'n' characters of text found on the page (Figure 2.). Users can scan text from the page in this manner and they can make a more informed decision as to which pages to explore further by clicking on them. This interface allows users too not only quickly scan hundred of hits at once but, numerous perceptual cues are added to convey more information as well. Arrows are drawn that show which pages in the search space are referencing other pages, the color intensity of pages indicate relevancy weighting, visited pages are marked to enhance navigation, etc.

Once information is found, we need to assimilate it into our existing knowledge structures and graphical representations can help with this process (West, Farmer et al. 1991). To facilitate, VisIT's graphical displays can be saved, and re-opened later. Users can edit the search space by deleting sites, grouping sites, making annotations on pages, labeling sites and more. Background images can also be inserted allowing users to place information on a meaningful referent (Figure 3). In this manner users can begin to construct a "knowledge space" from their search space, one in which they have taken information from various sources and constructed meaningful external representation or cognitive artifacts (Norman 1991).

Conclusion

Soloway and his colleagues (Soloway, Norris et al. 2000) recently pointed out that some are arguing that computers have failed in education. He shows that the failure is not in computers ability to be an effective tool but, that the failure is in the implementation of computers (or lack of implementation). Now that schools are connected to the Internet, we will soon be hearing debates on its effectiveness as an educational resource. However, unless educators better equip themselves and their students to succeed in learning on the Internet they will fail. Teachers and students need better tools to search and learn from the Internet and the early indications are that VisIT may point to a promising new direction. VisIT will be demonstrated in this session and participants will be able to try out the software for themselves.

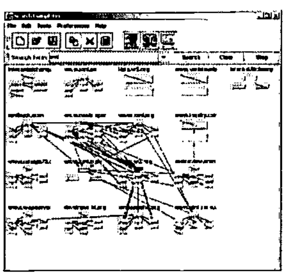

Figure 1. Initial Search Space in VisIT

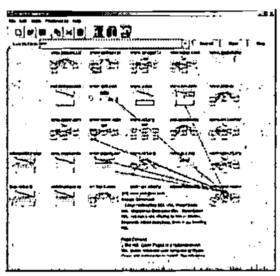

Figure 2. Pop-Up Box With Text From Page

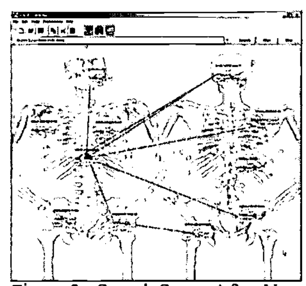

Figure 3. Search Space After User Modification and Background Image

The author is a doctoral student in Educational Psychology at the University of Illinois, Urbana-Champaign and is co-developer of VisIT along with Professor Jim Levin. I'd like to thank our programmers, Young Jin Lee, Hwan Jo Yu, Jeff Ellen and Arun Bhalla, without whom VisIT would not be possible.

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Influence of Home Access on Attitudes, Skills, and Level of Use for Teachers and Students in Technology Integrating Classrooms

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Abstract: The interaction of home access and school use of computers has been a topic of discussion among educational researchers for more than a decade. Evaluation of a U.S. Department of Education Technology Innovation Challenge Grant and a Preparing Tomorrow's Teachers to Use Technology Implementation Grant have given the authors an opportunity to address this issue within the context of large scale data sets gathered from several levels of formal education. This paper features findings related to the influence of home access to computers and the World Wide Web on the use of information technology in the classroom. Several positive and some negative indications are presented with respect to teachers, students, and technology at home and in school.

Procedures

Findings in this paper are based on self-reported survey data provided by teachers and students. Paper-based as well as on-line (html) data collection techniques were employed. Attitude and skill data were typically gathered using 5-point Likert type rating scales (strongly disagree = 1 to strongly agree = 5) or 7-point Semantic Differential items pairs (ex: Computers are: friendly __ __ __ __ __ __ __ unfriendly). Item responses were summed within categories producing reliable, content valid and construct valid measurement scales. Measurement properties of the Teachers' Attitudes Toward Computers Questionnaire (TAC), the Teachers' Attitudes Toward Information Technology Questionnaire (TAT), the Technology Proficiency Self-Assessment Questionnaire (TPSA), the Computer Attitude Questionnaire (CAQ), and the Young Children's Computer Inventory (YCCI) have been reported elsewhere (Knezek, Christensen, Miyashita, and Ropp, 2000).

Home Access to Information Technology for Teachers

Home computer access is associated with positive attitudes, skills, and levels of classroom use for teachers; home access to the Internet is even more strongly tied to positive indicators in these areas.

TAC, TAT, and TPSA data were gathered from 113 elementary and high school teachers in a public school district in Texas during spring 2001. Teachers who reported access to a computer at home had more positive ($p < .05$) ratings on 11 of 14 information technology indices gathered. Level of interest in information technology, as well as two measures of belief in the utility of electronic mail for classroom interactions, were not significantly impacted by whether or not a teacher had a computer at home. All 4 areas of assessed skill proficiency, including World Wide Web, using Integrated Applications, Teaching with Technology, and skill at using Email, were significantly higher for teachers who had computers at home. In addition, level of use for classroom integration, as measured by self-reported Stage of Adoption of Technology and self-reported Concerns Based Adoption Model Level of Use, was significantly higher for teachers with home access (Christensen and Knezek, 2001).

The analysis of the previous paragraph was repeated for teachers who reported having access to the Internet at home, versus those who did not. All conclusions were the same as those reported for computer access at home versus none, with the exception that the two measures of the belief in the utility of Email for classroom interaction were both significantly more positive for those with Internet access vs. those without ($p < .05$). Teachers who had access to the Internet at home were more positive in their belief that Email was useful for classroom interactions. Teachers who only had access to a computer at home, but not access to the Internet at home, were not significantly different in this area from teachers who had neither computer nor Intemet access at home (Christensen and Knezek, 2001).

In a third analysis, additional data gathered from 74 middle school teachers reconfirmed these findings for home computer and Internet access versus none, for attitudes and level of use (Christensen and Knezek, 2001). (Skill data was not acquired for these teachers.) It is hypothesized that teachers benefit from home access to a computer and the Internet because together these capabilities extend resources and access into a time and place outside the classroom, where teachers can take time to develop their own competence and confidence. It is also conjectured that if teachers use technology at home more often, then teachers will be more comfortable with technology in school.

Home Access to Information Technology for Students

> Home access by students is associated with greater skill in using Email and the WWW; however, greater access to information technology at home may also be associated with lower empathy (caring concern for thoughts and feelings of others) in elementary and middle school students.

YCCI data were gathered from 1737 K-6 students during the fall of 1999 and spring of 2000 from the eight elementary schools in north Texas. Analyses of this data from several perspectives indicated that the general impact of technology integrating teachers over several months, across grades 1-6, appears to have been the greatest in the area of Attitudes Toward Computers on students without computers at home. This was evidenced by significant ($p < .01$) declines in student attitudes toward computers, from fall to spring, among those students without home access to computers who also had low integrating teachers in school (Knezek and Christensen, 2000). Students without computers at home who had high integrating teachers in school showed no significant decline.

In a CAQ/YCCI study involving 218 7-12 grade students from a middle school and high school in a Texas public school system during the spring of 2000, and 113 elementary plus 87 middle school students from the same school system during the spring of 2001, the students with computers at home were found to have lower empathy at the elementary school level ($p < .02$), and lower empathy ($p < .09$) as well as higher skills on Email and WWW at the middle school level (skills were not measured for elementary). An additional finding from the same study was that access at home did not appear to be strongly related to (self-reported) student access in school ($f = .358$, 1x85 df; $p = .55$) (Christensen and Knezek, 2001).

The finding regarding empathy is worrisome and worthy of further study. The finding regarding home vs. school access is good news in that it implies that schools provide equal access to computers for all students, regardless of whether or not they have access outside of school. Further research is needed to determine if the hypothesized directionality of home access fostering classroom integration is accurate, if desire for classroom integration fosters home access, or if some other phenomenon is responsible for both.

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Examining Computer-Mediated Discussions of a Multimedia Case Study of Mathematics Teaching

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Abstract: The main goal of this paper is to examine how pre-service secondary mathematics teachers, in-service secondary mathematics teachers, mathematicians, and mathematics teacher educators communicated about a multimedia case study through computer mediated communication (CMC). Computer mediated discourse analysis (CMDA) (Herring, 2001) guided the data analysis phase of the investigation. The analysis revealed evidence of individual and group differences with respect to participation in CMC. For example, the average number of messages per day was 2.86 and the average number of words that the participants posted daily was 316.62. These values suggest that the participation rate was relatively high and that the computer-mediated discussion was active. The female participants presented their ideas briefly, and males wrote more. Males appeared to focus on more details, which is an interesting observation because traditionally it is believed that females focus on details more than males.

Introduction and Background Information

A survey of the literature indicates that educators possess a great interest in online environments for teaching. As yet, however, little systematic research is available that compares online communication with face-to-face communication in educational settings. Since Internet use has become widespread in teaching and learning contexts, it is essential to examine how computer mediated communication (CMC) influences human learning with respect to face-to-face communication. Key questions that need to be examined include, "Is CMC an effective tool in teaching and learning?", "Does CMC affect equality of participation among individuals?" and "Does CMC, in as much as it provides more time for reflection, enhance the sophistication of language used in educational settings?".

This paper illustrates some applications of Computer Mediated Communication (CMC) in a university-school collaboration project, the Collaboration for Enhancement of Mathematics Instruction (CEMI) project at Indiana University. The CEMI project aims to assist both pre-service and in-service teachers to develop their understanding of mathematics teaching and to create an effective collaboration between Indiana University and Monroe County Community School System of Bloomington, Indiana.

This research examines how four populations of people with a common interest in mathematics teaching and learning -- pre-service secondary mathematics teachers, in-service secondary mathematics teachers, mathematicians, and mathematics teacher educators -- communicate about a multimedia case study, Making Weighty Decisions (Bowers, Doerr, Masingila & McClain, 2000). Each of these populations can be characterized by their status in the mathematics education community because instructor-student relationships exist among them. For example, pre-service teachers are students of both mathematics educators and mathematicians. In addition, in-service teachers might be students of the university faculty. Thus, the participants' status will guide our descriptions of them. These people with varying status met both on-line and face-to-face to discuss the multimedia CD. In this paper, we report the on-line part of the CD discussions. Our goal is to examine how member of the four cultures communicate about the multimedia case study through CMC, making use of computer mediated discourse analysis (CMDA).

The purpose of the CEMI project is to engage members of the four cultures (in-service secondary mathematics teachers, in-service secondary mathematics teachers, university mathematicians and university mathematics educators) in Lesson Study Groups (LSGs) similar to those commonly found in Japan (Lewis & Tsuchida, 1998). Each LSG member was asked to view the multimedia case study CD and related materials individually and then to respond to on-line discussion prompts. Discussion prompts were designed to encourage participants to reflect on the teacher's role in planning for and facilitating classroom activities, the mathematical content of the lesson, and the level of student thinking throughout the lesson. The on-line discussion took place within the Inquiry Learning Forum (ILF) (http://ilf.crlt.indiana.edu) and proceeded for approximately five weeks.

Specifically, this study seeks to determine the following:

- What are diverse members of a professional community (in-service secondary mathematics teachers, in-service secondary mathematics teachers, university mathematicians and university mathematics educators) doing as they talk about mathematics teaching and learning?
- What role and power structures are influential among the participants?

Data Sources

Each of six Lesson Study Groups (LSGs) engaged in two online discussions. The first one lasted two weeks (from 09/11/2000 to 09/25/2000) and then members met face-to-face to reflect on the CD after that. Next, another three-week online discussion took place (from 09/25/2000 to 10/16/2000). Finally, a second face-to-face meeting provided an opportunity for the participants to share their ideas. In this study, we used the transcripts of on-line discussions of the multimedia case study by three LSG as data sources. It should be noted that since each LSG engaged in two online interactions, we analyze six sets of data, three of them are from the first discussion and the other three are from the second one. We selected the three LSGs among six of them randomly. Each of the three LSGs includes one teacher, one mathematics educator, one in-service teacher and three to four pre-service teacher. In addition, two of them include a mathematician. Totally, we analyzed postings of 18 people, 8 males and 10 females. However, two female pre-service teachers only engaged in the second discussion.

In this study, we analyzed regular e-mail messages posted on discussion lists, thus our data is typical form of asynchronous Computer Mediated Discourse (CMD) with one-way transmission (Herring, 2001). Herring characterizes e-mail based systems as asynchronous CMD forms because they do not require that the users be logged on at the same time. She also proposes that e-mail based systems are an example of one-way transmission in CMD because "a message is transmitted in its entirety as a single unit (p.615)."

Methods/Theoretical Approach

Computer mediated discourse analysis (CMDA) (Herring, 2001) guided the data analysis phase of the investigation. Specifically, we obtained descriptive statistics on participation by role and gender, and conducted pragmatic analysis of speech acts. We analyzed participation for each discussion for CMC. This involved counting the number of messages and number of words contributed by each participant as a means of determining whether the project members participated in the discussions equally. In addition, we examine whether some groups dominated other groups.

We also used the exchange structure of Francis and Hunston (1992), originally developed by Sinclair and Coulthard (1975) for the analysis of classroom discourse, to analyze the transcripts of the discussions. Exchange structures are sequences of speech acts (agree, inquire, inform, react, etc.) produced when individuals are engaging in conversation. The model was developed for face-to-face conversation, but has been applied to educational CMC by Herring and Nix (1997). The goal of the present analysis is to understand what kind of speech acts takes place in CMC in discussing the multimedia CD. Additionally, we compared the speech act usage of groups within the groups.

Results

What follows are some examples of the results. Although we have many interesting results, we cannot report all of them due to space limitations.

Participation

Overall

Descriptive statistics reveal that 18 participants posted 106 messages during a five-week period. The participants posted more messages in discussion1 than in discussion2, although discussion2 lasted one week longer. The moderator posted four messages prompting the discussions in discussion1, but two messages in discussion2. This might have the reason for fewer messages in the second discussion session.

As it can be seen from Figure1, the average number of messages per individual for discussion1 and discussion2 is 3.81 and 2.50, respectively. Interestingly, in discussion1, the average number of messages per mathematician (5.00 messages) is significantly higher than the average number for the entire population in discussion1 (3.81 messages). Because the mathematics educators posted only two messages during the first discussion (average= .67 messages), the average number of messages in that discussion session was decreased.

Figure1: Average number of messages

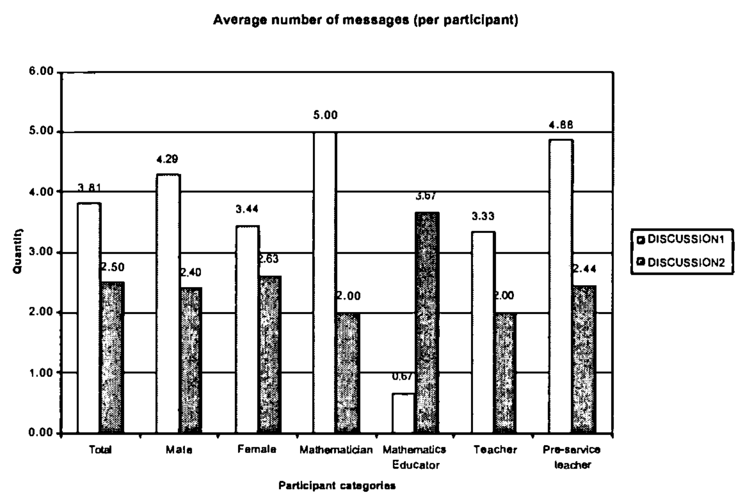
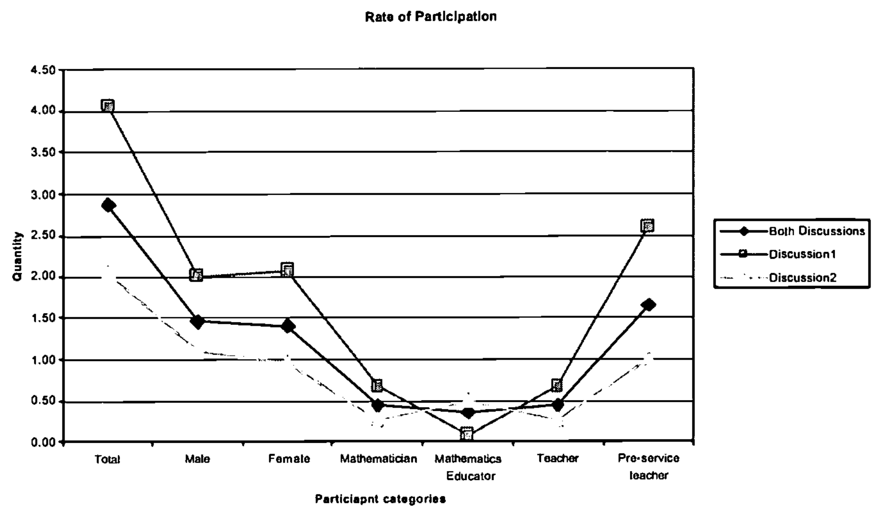


Figure2 indicates that the average number of messages per day is 2.86 and the average number of words that the participants posted daily is 316.62. These values suggest that the participation rate is relatively high. The participation rate is considerably high for discussion1 (4.07 messages). In discussion1, the participants were asked to respond to clear-cut questions. In other words, they were not open-ended; however, in discussion2, the moderator asked open-ended questions so that the participants could post all their comments and critiques. It seems that open-ended questions might have decreased the rate of participation in the second discussion although it lasted three weeks.

Figure2: Rate of participation



In addition, the average message length is 110.52 words, indicating that the participants posted long messages. Since the participants are highly educated people, this finding seems reasonable. Finally, the statistics indicate that the computer-mediated discussion was active. The participants also posted almost equal size of messages both in discussion1 (109.34) and discussion2 (112.11). The average values are almost the same for discussion1 and discussion2. Previously, it was revealed that the participants posted more messages in discussion1 than in discussion2. However, now it is found that although they did not post the same number of messages in the discussions, the size of the messages are similar. This is not surprising because the same individuals posted all the messages.

Group Differences

The data show that 10 females posted 52 messages and 8 males posted 54 messages. In other words, the average number of messages posted by males (6.75 messages) was higher than the average number of messages posted by the females (5.2 messages). It may mean that males expressed themselves more than females. In addition, the average length of messages posted by males was 118.06 which was larger than 102.69 of females. This finding suggests that females presented their ideas briefly, but males wrote more.

Also, there were significant differences among the cultural groups participating in this study. For example, the average message length was 100.25 words for pre-service teachers; however, this value was 126.13 words for mathematicians and 154.69 words for mathematics educators. These findings seem meaningful because pre-service teachers may know less about teaching than mathematicians and mathematics educators.

Speech Acts

Overall

Overall, the participants were engaged in 678 speech acts throughout the online discussions. The speech act analyses indicate that generally the participants are informing each other, sharing their observations, inquiring and commenting on their own statements as they discuss the multimedia case study. These results are consistent with the findings of Herring and Nix (1997) for a distance education course. However, unlike in Herring and Nix's study, the participants use very few directive speech acts, suggesting a relatively polite and egalitarian environment.

Group Differences

It was revealed that females asked more open-ended questions (14) than males (8 questions; inquiry). Possibly females wanted to learn the details of the multimedia case study more than males. Another striking result is that pre-service teachers asked more questions than any other status group (13 open-ended questions out of 22). Although asking questions can be considered as the symbol of power, the group with the least power asked more questions. On-line communication might have resulted in this finding. The pre-service teachers might have felt more comfortable. Thus the traditional roles of teacher-student were not preserved in the computer-mediated environment.

It was revealed that that males share their observations (45 times) more than females (31 times), while females asked more open-ended questions. Pre-service teachers shared their observations mostly (47 out 76 times). This may be because as students they regularly prepare assignments including reflections, descriptions and observations.

Conclusions/Implications

The basic goal of this study was to examine how pre-service secondary mathematics teachers, in-service secondary mathematics teachers, mathematicians, and mathematics teacher educators communicated about a multimedia case study through CMC, making use of computer mediated discourse analysis (CMDA). CMDA helps us understand teacher education phenomena better. The analysis reveals empirical evidence of individual and group differences with respect to participation in CMC. Revealing such differences can help teacher educators and instructional designers build online communities in teacher education settings. Participation statistics also provide evidence that helps us to understand power dynamics within the online community. In this study, power structures are potentially always an issue because instructors and students share the same context. Since teachers have more authority than students, in our research we expected to see teacher educators and teachers participate more. We also observed that members of different groups used some speech acts more than others, indicating that participants have diverse intentions.

As an extension of this study, we will analyze the face-to-face discussions of the same multimedia case study by the same people. Therefore, we will be able to compare and contrast both modes of communication. That study will improve our understanding of online professional development of teachers. In particular, we may uncover some strengths and benefits of CMC over face-to-face communication.

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The renewal of teacher education through networked learning communities: Evolutionary or revolutionary?

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Abstract: The paper considers the framework within which information and communication technologies (ICTs) integration can support teacher education renewal through collaborative learning. Adopting a socio-constructivist approach and a design-experiment methodology, our research team experimented in different contexts, and presents results pertaining to networked learning communities. The identification of themes and patterns in the activity of these learning communities lead to a discussion of ways of renewing teacher education by integrating ICTs in a way which supports collaborative teaching and learning.

Introduction

For the past seven years, co-authors have integrated information and communication technologies (ICTs) in their teaching and research[1]. Judicious use of ICTs in order to further the understanding of ideas, practices, and concepts as well as pedagogical principles and notions has captured their imagination. With other colleagues, they set in 1995 to design a virtual community of support and communication for pre-service teachers as the first phase of a TeleLearning Professional Development School (TL-PDS). Moved by the vision of interconnected learning communities, each site contributed through an already successful innovation with regard to teacher education.

At the University of British Columbia/Vancouver site, a community of inquiry was an alternative route provided to interested students registered to the post-baccalaureate teacher education program. In Toronto, the CSILE Team was developing the next generation of its computer-supported intentional learning environments. At the McGill University/Montreal site, summer institutes attended by in-service teachers were already focusing on new learning technologies. And at the Laval University/Quebec City site, a network of professional development schools (PDSs), called *Le réseau des écoles associées à l'Université Laval* was already in place.

Working from their own locus of strength, each site soon began to design new learning practices supported by ICTs for their own communities (pre-service and/or in-service teachers interested in making sense of ICTs for teaching and learning). At first, six design principles revealed to be critically important: ease of access to ICTs, co-constitutionality, participatory design, local grounding, multi-modal social interactions, and diversity[2]. Other design principles apply more directly to the socio-constructivist approach adopted: the classroom as-a-community of learners, active collaborative learning, progressive distributed expertise, collaborative reflective teaching, collaborative knowledge building, and interrelatedness[3].

[1] This work was done with the support of the TeleLearning Network of Centres of Excellence, Canada.

[2] Brief definitions of these principles are the following: Ease of access: Networked computers and online resources and tools need to be accessible without loosing too much time once basic technical skills are mastered. Co-constitutionality: The development of a socio-technical infrastructure relies on electronic connectivity on the one hand, and on people who value collaborative learning and knowledge on the other; one is not significant without the other. Participatory design: The development of networking capacity involves university-school administrators (partnerships), university- and school-based teacher educators, in-service/pre-service teachers, and K-12 learners. Local grounding: Site-based professional learning communities provide grounding. Multi-modal social interactions: At a local level, learners meet face-to-face, on campus or at the professional development school. Diversity: Learning communities are different in their local champions, circumstances, settings, tools, artefacts, cultures, and languages (in particular English and French).

[3] The socio-constructivist principles applied are briefly defined as follows. The classroom as-a-community of learners: K-12 learners as well as pre- and in-service teachers are learning in networked classrooms designed to become centers of inquiry where people, things, and ideas are valued, and where teaching for understanding is a common goal. Active collaborative learning: The networked classroom fosters active collaborative learning rather than individual learning. Progressive distributed expertise: Teacher knowledge, which is distributed among and far beyond individual participants, may be accessed; virtual collaborative spaces provide opportunities to share resources and expertise to solve complex and ill-structured problems. Collaborative reflective teaching: The design task is that of providing a collaborative learning environment within which problem-setting and problem-solving are carried out in relation to real classroom events.

The latter principles are of a transformational nature, and the driving idea is that knowledge of technology in education is a key driver and a key enabler. This paper tackles the complexity that hides behind the following simple statement: a visible and durable change in teacher education is not an easy task, and is particularly delicate with regards to innovative pedagogical practices by means of technology. Periodical analysis such as the ones by Cuban (2000) demonstrate it. Zhao, Byers, Pugh, & Sheldon (2001) suggested to take the "evolutionary rather than a revolutionary approach to change" with respect to school teachers. We argue that this path needs not only to be taken with school teachers but also to the ones expected to be the providers, namely teacher educators. The networked learning communities our R & D Team has been designing brings evidence to this end.

Method

Applying the innovation model developed by Zhao et al. (2001), themes and patterns already identified in the analysis of the design and development of networked learning communities (Laferrière, Breuleux, Erickson, and Lamon, in progress) are reflected upon. Those themes and patterns regard the technical and conceptual appropriation of the technical tools by the learning communities. They emerged from qualitative analysis (design experiment approach, Brown, 1992) of the data accumulated over a sixth-year period, and gathered through participant observers' notes, interviews, discussion forums, and other artifacts produced by these communities.

Findings

The networked learning communities may have been first initiated for pre- or in-service teachers, they came to all include pre-service teachers, in-service teachers, graduate students, and teacher educators. In most instances, school learners were all considered members of the learning communities.

The following themes and patterns were identified as benchmarks of progress regarding the technical and conceptual appropriation of ICTs by the learning communities:

1. *the screen is no longer the screen.* The importance attached to social interaction is rediscovered and the networked computer is no longer perceived by the practicing or future teacher as a tool which isolates its user (pupil or student) but as a tool which supports classroom interaction perhaps beyond the limits of normal timeframes ;
2. *technical support is provided by many learners.* In spite of its status or of the status of the individual who is using it, technical support is favorably welcomed by the learner who does not hesitate, in turn, to act in such a way in relation to other learners ;
3. *ties, which begin to bind, people, texts and ideas.* These ties transcend time and space within all described communities. Participants were able to become involved in forms of collaborative inquiry by building from available resources and by exchanging their ideas. These opinions were subject to critical review and were considered and qualified by other students and by instructors. According to this perspective, teacher candidates as well as in-service teachers were able to put forth their contribution in relation to the subscribed and developed ideas. This experience had the effect of modifying the pedagogical relationships within the classroom. The experience also created new pedagogical relationships outside of the class. This also allowed for an increase in face to face dialogues between participants ;

Collaborative knowledge building: This refers to the design of a rich learning context within which meaning can be negotiated and ways of understanding can emerge and evolve. Student teachers engage in designing and inventing tasks such as the organization of the networked classroom, the development of learning projects, the scaffolding of online group or classroom conversations, and the creation of case studies. Interrelatedness: Knowledge objects, events, actors, artefacts, and authors interconnect in ways that add continuity and integration to student teachers' experience as they learn to teach in networked classrooms. They add as well to the experience of practitioners working in networked classrooms.

4. *the level of understanding of a question or problem of one person becomes an inscription available to someone else for reactivation.* The support which must be provided is facilitated by the fact that thought becomes visible in the electronic forum and from the fact that peers contribute; the difficulties experienced by some having recourse, half-way through and in a generalized way, to theoretical perspectives likely to enlighten their reflective practice, become evident in their own eyes, as well as their progress in relation to this undertaking ;

5. *roles are exercised in a dynamic manner.* By inverting the roles of teacher and student in an authentic way (for example, the documents prepared by more advanced student teachers are consulted by the new pre-service teachers in a learning community; the number of readers consulting the work of teacher candidates is widened; teaching notes are written by elementary school learners), participants contribute to the collective knowledge on a given theme or problem ;

6. *the act of writing is part of the research process.* There exists an undeniable potential for immediate feedback. And the continuity of the exercise offers an anchor point for continued reflection. Students who wrote not only for their peers but also for other agents in the field as well as for researchers became initiated into a language used within academic and professional communities. They also positioned themselves by recognizing authority and expertise in the subject matter through the building of community's discourse ;

7. *the number of readers and authors is increasing.* This increase in the number of readers consulting the work of pre-service teachers can make the writings more reflective. That is to say that students' work is not simply a transfer of knowledge to be read by the professor.

These seven themes and patterns capture what participants' in the learning communities have been doing in an increasingly visible manner. The model put forward by Zhao et al. identifies three interactive domains: the innovator, the innovation, and the context. In the case presented, the innovator is a domain extended to all the participants of a specific learning community; the innovation is the learning community, and the context is the faculty of education and partner schools (PDSs).

The innovator' technology proficiency is the first factor identify by Zhao and colleagues that leads to the success of an innovation. Theme 1, *the screen is no longer the screen* and theme 2, *technical support is provided by many learners.* They point out that knowledge of the technology and its enabling conditions plays a major role, and this is also true for the learning communities as the above themes evidence. The second factor Zhao et al. stressed is compatibility between teacher pedagogical beliefs and the technology. In the design experiment, the research team defined telelearning as the use of ICTs for learning purposes. This reflected a belief in socio-constructivism and collaborative learning. Therefore, electronic forums became, besides the Web browser and search engines, software applications of choice. Theme 3, *ties, which begin to bind, people, texts and ideas*, reflects this pedagogical choice. Pre- and in-service teachers as well as teacher educators uncovered together the possibilities of electronic forums for collaborative inquiry. Social awareness is the third and last factor related to the innovator that Zhao et al. identify. They meant the understanding of and ability to negotiate the social aspects of the school culture. In the design experiment, the on-line activity was challenging at times for student teachers that happened to be doing their student practicum in a more traditional classroom (see themes 1, 3 and 5). At other times, it was challenging to school-based or university-based teacher educators who were not ready to make their own thinking visible in the discussion forum (see theme 4). As innovators, participants in the learning communities had to be thoughtful of the values and beliefs of those "of-line" with whom they were pursuing some professional activities.

The three factors that Zhao et al. point to regarding the innovation itself are the following: the project's distance from school culture, the project's distance from available resources, and the project's distance from innovator's current practices. Here again, these three factors bear some relevance in order to describe the learning communities' activity. Distance from school culture was reduced at all universities by the very fact that the learning communities grew out of already existing successful innovations at each site. Distance from available resources has become les and less a difficulty for pre- and in-service teachers. Except in a few cases, this difficulty has now been overcome. As for distance from existing practice, the reality is that, on a daily basis, old and new pedagogical practices coexist. And each time there is an incoming cohort of new members, they vividly feel the distance from their existing learning or teaching practices. Overall, by reflecting the transformational nature of the activity of the learning communities, the seven themes also reflect the distance of their doings from traditional teacher education.

The last three factors identified by Zhao and her colleagues relate to the context: the human infrastructure, the technological infrastructure and social support. One of the TL-PDS design principles is co-constitutionality, meaning the development of a socio-technical infrastructure relies on electronic connectivity on the one hand, and on people who value collaborative learning and knowledge on the other. Themes 3-7 reflect the social dimension of the infrastructure created, whereas themes 1 and 2 reflect its technological dimension. Social support was provided on campus from the dean's office, a few close colleagues, and colleagues from other sites also receiving a federal telelearning grant from the Network of Centres of Excellence Program.

Discussion

Throughout the past six years, the three dimensions of the model here applied interacted with one another in an evolutionary manner. Their respective boundaries were redefined a number of times. For instance, at the very beginning, the innovators were the teacher educators/researchers at each of the sites. As partnerships with schools got established, the number of innovators expanded. To become a member in a network-enabled learning community (pre-service or in-service teacher or teacher educator) meant being an innovator among his or her peers or colleagues, and having to be tactful with regard to how to present one's doings and the doings of the learning community in a professional context where teachers or teacher candidates were less familiar with the use of ICTs. One of the design principles being interrelatedness, continuity and integration efforts have been supported by websites which included the artifacts of more advanced participants and of whole cohorts of pre- or in-service teachers. As a learning community grows along the vision of interconnected learning communities, the network of learning communities becomes a new social context in and of itself, one capable of virtually creating a "critical mass" of a particular innovation. Whereas before the innovation, that is, the learning community, would have been isolated in a given context, a new context emerges out of the synchronous and asynchronous interaction of learning communities.

Zhao and her colleagues studied individual innovators. In the design experiment, teacher educators/researchers took a community approach. Therefore, much interaction within and between the three dimensions has been observable: there are many innovators or participants invited to become more innovative in their learning and teaching; there are learning communities in which the old and the new cohabitate; and there are contexts (schools and faculties of education) whose organizational culture is evolving as it becomes increasingly aware of ICTs' potential for teaching and learning.

This new ecology may seem to be a progress, but it should not distract innovative teachers and teacher educators from the sustainability and scalability issues now well pointed out in the research literature (Blumenfeld, Fishman, Kracjik, & Marx, 2000). The majority of teachers and teacher educators still lack the technology proficiency (*the screen is still a screen*) necessary in order to reconcile their views of learning on-line and learning face-to-face, learning alone and learning together.

Conclusion

Networked learning communities are a framework within which ICT integration to curriculum is most likely to support teacher education renewal through collaborative learning and knowledge building. It is a framework well-aligned on the new theory of learning (Bransford, Brown, & Cocking). Moreover, it is an approach with which we, as teacher educators, came to make sense of ICT in our teaching and learning, and one that is speaking to other teachers interested in the renewal of their teaching as we collectively engage in the knowledge age.

The idea of replacing one or many pre-service teacher education courses by creating networked learning communities, ones also inclusive of beginning teachers and competent teachers and researchers interested in deepening their understanding of driving questions is likely to sound revolutionary to many school-based and university-based teacher educators (Laferrière, Bracewell, Breuleux, Erickson, Lamon, & Owston, 2001). We know, in fact, that for such an idea to grow, a slow evolutionary process is likely to take place.

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Effectiveness of Statistical Training with Computer Simulation

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Abstract: The effectiveness of computer simulation in statistical training was investigated in two experiments. In the first experiment, subjects learned the Law of Large Numbers either by watching a computer simulation or by reading a textbook chapter. Prior to the training, subjects were presented with either specific or non-specific content-related questions. Post-training test showed that simulation-based training significantly increased the quality of subjects' reasoning on real-world problems. Question specificity had only a marginal effect on the performance. In the second experiment, the effects of simulation- and textbook-based training were measured immediately after the training as well as after a one-week delay. After the one-week period, subjects trained with simulation not only outperformed those trained with textbook on both a knowledge test and a transfer test, they also benefited motivationally. These findings provide empirical evidence in support of the use of advanced computer technology in educational settings.

With the rapid development of information technology, educators now have at their disposal a great variety of technological applications as instructional tools. The area of statistical education is no exception. In recent years, a substantial amount of resources has been invested in the development of computer simulation programs illustrating various statistical concepts and principles. As a result, statistical simulations are now widely available through the Internet and have become an integral part of statistics curricular at various educational levels.

The increasingly important role that computer simulation has played in training demands an equal amount of effort to assess the effectiveness of these programs. Research on the merits of computer simulation in science education has been conducted in a variety of subject domains, including biology, physics and economics, but the results from different studies often lack consistency. The potential of computer simulation in statistical education has also been investigated in a number of studies, again with mixed outcomes. For example, Wackerly and Lang (1996) found that students learned better with computer simulations compared to those using more traditional materials. delMas, Garfield, and Chance (1999) reported using a computer simulation program to illustrate sampling distribution in a classroom setting. They found that the graphical display of the simulation could aid learning but was most effective under certain conditions, such as being paired with a strategy that directed students' attention to certain features in the simulation. Simply going through the simulation process did not necessarily result in conceptual changes. These researchers therefore concluded that computer simulations alone do not guarantee superior learning.

Statistical training has often been considered as being abstract and difficult to understand. As many have observed, too often students develop only a shallow and isolated understanding of important concepts and fail to apply these concepts in their reasoning. In view of current state of practice, there is a great necessity to search for better ways to facilitate the learning process in statistical education. The current study sought to evaluate the effectiveness of a sampling distribution simulation program developed by Lane (1999). Specifically, we expected that the dynamic, graphical presentation of information is more congruent with the essence of the training subject than a traditional textbook-based approach, thus could facilitate students' learning and transfer (see Lane and Tang 2000 for a more comprehensive description of the study.)

Experiment 1

Method

The experiment used a 2 x 2 factorial design. The first factor was the content delivery medium used in the training. Subjects learned the concept of sampling distribution and the Law of Large Numbers either by watching a computer simulation demonstration adapted from the Rice Virtual Lab in Statistics (Lane, 1999), or by reading a textbook chapter. The chapter was largely text but included examples, graphics, mathematical formula and a table detailing a hypothetical sampling distribution as well. Prior to the training, subjects read two real-world scenarios that pitted a smaller sample against a larger sample. Each scenario came with questions regarding the sampling outcome as a result of different sample size. The questions were either specific or non-specific. In the specific condition, subjects were asked which sample size would lead to a particular outcome. In the non-specific condition, subjects were simply asked what would happen. Question specificity constituted the second factor of the design. In addition to the above four conditions, a no-treatment group was also employed as control.

One hundred and thirteen Rice University undergraduate students who had no formal statistical training participated in this experiment in exchange for extra credit in a psychology course. Subjects were trained and tested in small groups of 4 to 12 people, and their assignment to experimental conditions was randomly determined. In the experiment, subjects first took a 12-minute paper-and-pencil Wonderlic Personnel Test (as a measure of general cognitive ability). Then the four treatment groups were presented with the two real-world scenarios, and went through a specific training session depending on their condition. Each training session lasted between 25 to 30 minutes. At the end of the training, subjects in all the four treatment groups were given explanations as to how to apply the training to the previous two examples to reach the correct answers. They then took the post-training test. Procedure for the control group was slightly different. Subjects in this condition took the second test without going through the training.

The post-training test was designed to measure how well subjects could transfer the training to novel situations. The test consisted of 12 real-world scenarios embedded in contexts very different from those encountered during the training. Among them, nine problems could be solved by applying the Law the Large Numbers and thus constituted the critical items in data analysis. The remaining three problems served as filler items. Subjects' reasoning on each transfer question was rated on a 3-point scale, where 1 indicates an entirely deterministic response, 2 a poor statistical response, and 3 a good statistical response. Two coders, blind to subjects' condition, each coded the responses from a random sample of 18 (16% of all) booklets separately, and agreed on 83% of the answers. This inter-rater consistency was accepted and one of the two coders then continued to code the rest of responses.

Results

A statistical reasoning score was derived for each subject by averaging across the nine critical transfer problems. The average reasoning score from all the subjects were then analyzed using the Analysis of Covariance (ANCOVA) procedure, with subjects' Wonderlic test scores as the covariate. Figure 1 shows the boxplots of the mean reasoning scores as a function of experimental condition. As can be seen in Fig. 1, both simulation-based training groups scored higher than the two textbook-based groups. The difference was statistically significant, $F(1, 107) = 5.64$, $p = .019$. Groups that were presented with specific questions prior to the training did slightly better than groups presented with non-specific questions. However, this effect only reached marginal significance, $F(1, 107) = 3.75$, $p = .055$. The interaction between training medium and question specificity was not significant, $F(1, 107) = 1.94, p = .167$. The boxplots also show that all the treatment groups performed better than the control group. The difference between the control and the average of the four treatment groups was significant, $F(1, 107) = 20.96$, $p < .0001$. Dunnett's test further showed that three of the four treatment groups significantly outperformed the control group ($p < .05$), with the textbook/non-specific question group being the only exception.

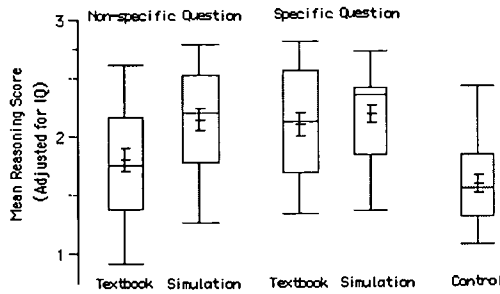

Figure 1. Statistical reasoning score as a function of experimental condition (Small bars on boxplots depict group mean ± one standard error)

The results from experiment 1showed that simulation-based training led to improved statistical reasoning on ill-defined everyday problems as compared to a traditional textbook-based approach. However, because the post-training test took place immediately after the training, it remained unclear whether this advantage would last over time. Therefore, a second experiment was designed to address this issue.

Experiment 2

Method

A 2 X 2 factorial design was employed. The first factor was the content delivery medium in the training (simulation-based vs. Textbook-based). The second factor was the timing of post-training test. Half of the subjects in each medium condition were tested immediately after the training, and the other half were tested after a one-week delay. A 5th group took the transfer test without receiving the training and thus served as the control.

Training materials for both simulation- and textbook-based groups were the same as in Experiment 1. Testing materials in the current experiment included two sets of questions. The first was a knowledge test consisting of 10 multiple-choice questions. All the questions as well as their respective alternates were phrased in statistical terms. The second set was a transfer test that consisted of 10 real-world scenarios from the first experiment. Seven of the 10 items are the critical items that required applying the Law of Large Numbers in reasoning. The remaining three were filler items. After the training groups took the post-training test, they filled out a questionnaire measuring their attitudes towards the training. The questionnaire contained 11 items and was centered on subjects' self-evaluation of their test performance as well as their judgment about a particular training method. Subjects' responses were based on 5-point Likert scales.

One hundred and three Rice University undergraduate students with no previous statistical background participated in this experiment. The experimental procedure and coding system for the transfer questions were the same as in Experiment 1.

Results

Subjects' accuracy on the multiple-choice test is shown in Figure 2 as a function of training condition. The data was analyzed using the ANCOVA procedure, with Training Medium (2) and Delay (2) as between-subject factors and Wonderlic scores as the covariate. As can be seen in Fig. 2, subjects trained with simulation were more accurate in this knowledge test than those trained with the textbook. However, the difference between the two medium types did not reach significance, $F(1, 79) = 2.35$, $p = .130$. Though subjects' performance became slightly less accurate after the one-week delay, the difference, however, was not significant, $F(1, 79) = 0.48$, $p = .492$. There was also no evidence of interaction between training medium and delay, $F(1, 79) = 0.14$, $p = .706$.

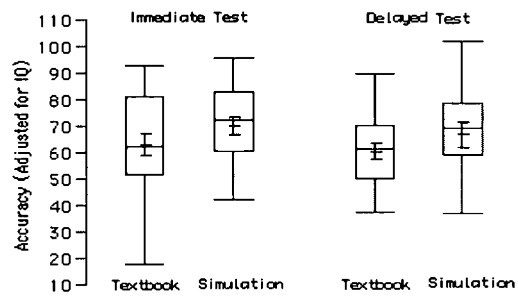

Figure 2. Accuracy on statistical knowledge test as a function of training medium and test timing

Subjects' statistical reasoning score on the transfer test is presented in Figure 3 as a function of experimental condition. A comparison between the training groups and the control group revealed that, overall, training significantly increased the training groups' statistical reasoning on these transfer questions, $F(1, 97) = 7.57, p = .007$. Consistent with the finding of experiment 1, subjects trained with simulation scored higher than those trained with textbook, $F(1, 97) = 3.20, p = .038$ (one-tailed). Subjects' reasoning scores were essentially the same on the immediate and the delayed test. Neither the effect of delay nor the Training Medium by Delay interaction approached significance, $F(1, 97) = .00, p = .994$; $F(1, 97) = .02, p = .894$, respectively.

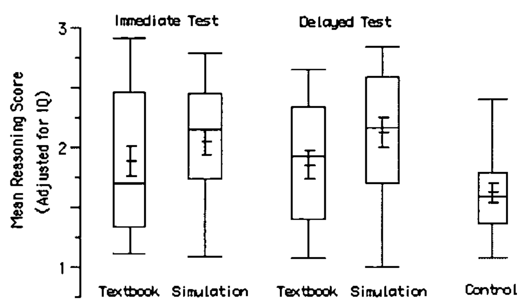

Figure 3. Statistical reasoning score as a function of experimental condition

Subjects' responses to the survey items showed that their self-perceived effectiveness of a training method did not differ much as a function of experimental condition. However, training medium did have a large impact on subjects' motivation. As shown in Fig. 4, subjects trained with simulation gave significantly higher rating on the motivation scale than those trained with textbook, $F(1, 80) = 22.76, p < .0001$. Although the difference was more evident after the one-week delay, the Training Medium by Delay interaction was not significant, $F(1, 80) = 2.10, p = .151$. The main effect of delay was also not significant, $F(1, 80) = 0.01, p = .916$.

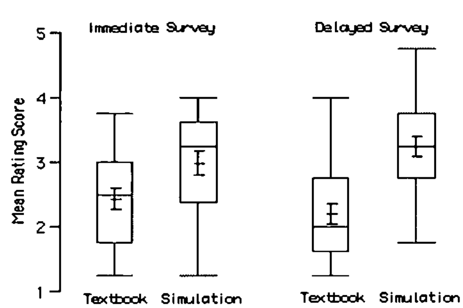

Figure 4. Motivational rating score as a function of training medium and delay

Discussion

The current research provides robust evidence regarding the effectiveness of computer simulation in statistical training. The training content in this study, the Law of Large Numbers, was considered an important yet complicated topic. Bassok and Holyoak (1989) have shown that college student had great difficulty transferring this rule across problem domains. In another study, Nisbett, Fong, Lehman, and Cheng (1988) found that their subjects were able to transfer this principle to new domains immediately following training but not after a two-week delay. In the current study, after going through a 30-minute training session, subjects trained with simulation were more able to identify the key elements of ill-defined everyday problems from a statistical perspective and apply the principle thereafter than subjects trained with a textbook. The benefit of simulation over textbook was manifest immediately after training as well as after a one-week delay. Therefore, the current result suggests that simulation-based training could result in better learning of statistical concepts and further lead to reliable transfer in complex reasoning tasks.

In statistical training, students' motivation often contributes substantially to the learning outcome (Gal & Ginsburg, 1994). Anecdotes had it that students in the classroom are more intrigued by computer simulations than traditional lectures. This idea was put to test in the current study. Although subjects trained with either simulation or textbook rated both training methods as being equally effective, those in the simulation condition consistently gave more favorable opinions when the questions tapped into motivational aspects, such as ease of learning and personal preference. The result thus provides evidence regarding the motivational benefit that students gain from simulation-based training.

The current study emphasized dynamic visual presentation of information in simulation-based training. While visual elaboration is one important characteristics of computer simulation, it is by no means all that simulation has to offer. Many researchers argue that a simulation-based environment is most effective when students are allowed to explore and reach the underlying model on their own. Therefore, user interaction in simulation-based training warrants further research.

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On Educating the Future Generation: Rethinking the Role of Teachers in the Technological Era of the New Century

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Abstract: This paper discusses the role of teachers from three aspects. First, it posits that we are living at a final stage of the printing-based culture. All teachers must maintain a new worldview that the change is cultural—as what machinery in the Industrial Revolution had transformed our world—it will be changed dramatically by computer technologies. So will be school learning. Second, it proposes that teachers must adapt themselves to meet the new technological environments. Third, teachers need necessary and timely support to sustain their willingness so that the change and readjustment can proceed smoothly.

Decker Walker (1999) explains, "Future generations will value the ability to use information technology as highly as we value the abilities to read and write today" (p. 9). With the advancement of computer technologies into our lives, work, and everywhere today, one of educational debates is no longer whether schools need to use technology, but how and when to use it effectively. In future education, it would become impossible without computers for teachers to offer enriched learning opportunities. When educating children in a technology-oriented environment, teachers must rethink their role.

When looking around us, we must admit that technology is a most remarkable thing that differs our world—yesterday's from today's and today's from tomorrow's. Taking the Internet as an example, we can see how technology has affected the world. As an outgrowth of the Cold War known as ARPANET for military purposes during the 1960s, the Internet navigation was first released to the public in 1991 (Provenzo, Brett, & McCloskey, 1999). However, within a few years, it has spread amazingly wide. Today, more than 60% of American households with children have computers with Internet access ("Know Future," 2001). A survey by the National Center for Educational Statistics also reported that 95% of US public schools had access to the Internet by 1999.

The computer has become an icon of our times and is endowing our society with a new definition—the technological era or the information age. Let's think about the Industrial Revolution of the 18th century, which transformed many Western countries from a rural to an industrial economy. Yet, at the core of this revolution was technology such as the steam engine that had functioned centrally. The automobile is another example on how technology has shaped our cities and lives today from those of 100 years ago. Should the way we shop, where we work and live be different had we no automobile today? As Provenzo, Brett, & McCloskey (1999) stated, profound social and cultural changes took place as a result of the introduction of new technologies. We are now living at a final stage of the printing-based culture and the computer technology has affected a crucial change in our culture.

Facing this cultural change, teachers must readjust their role. In a traditional paradigm, teachers serve as the role of the transmissive tool of knowledge (Hunt, 1997). Under most circumstances, when people are comfortable with what they're used to, the change would be reluctant since people are more likely to use familiar and trusted tools. However, those *trusted tools* are inadequate for preparing the school children safely into the digital world. As the cross-century ambassadors for better education, teachers must acquire the new ability to use technology to meet children's needs. In some way, teachers need to take a learner's role to obtain technology skills for instructional use.

In recent years, the computer use in school has been increasing rapidly. A report from the U.S. Department of Education revealed that there were approximately 8.6 million instructional computers in schools throughout the United States in 1998 and an estimated 4 million dollars was spent on educational technology and the Federal Communications Commission also set up a 2.25 billion dollar annual fund to assist school libraries with funding for Internet connections. However, the same report also found that mere 20% of teachers felt they were well prepared to utilize technology in their classrooms. This means that the large masses of machines and technological access in fact did not help much to construct quality instruction for teachers in classrooms.

The reasons are many. Yet, the two obvious ones are teachers' fear and inappropriate institutional support. The computer is undoubtedly a powerful tool that can help achieve many instructional goals. However, the machine is valuable only when human intelligence organizes its use productively and if teachers do not know what to make of the tool, fear it, or misconstrue its use, it will only be used badly. A critical fact is that many middle-aged teachers over forty didn't learn to use computers while at college and they are now the mainstay in the teaching force. We can understand that it could be a fearful feeling for adults to look a fool and it thus is easy for teachers to feel uncomfortable with the *machine*, especially when the badly needed support is missing.

In most situations, teachers are willing to learn to use new technologies for their professional and curriculum activities. But a lack of teacher-development program and time dedicated to experimentation can hinder teachers' technology skills and knowledge (Schrum, 1999). Some ongoing programs, for example, are only intended to provide teachers with a brief exposure of training and practice to incorporate technology into classrooms, which is insufficient. Gaining technology skills differs from learning a new teaching model and it needs time. While urging for teachers to readjust their roles under the impact of the technology change, we must understand that they need necessary institutional support to sustain their willingness so that the readjustment can proceed s moothly.

Providing a staff development program must be based on specific needs. The training program is only effective when it can give teachers opportunities to apply their new skills. It's not only timesaving but also easy for teachers to accept the new approach at the site when a problem occurs. Among various means to make technology-oriented professional development successful, Schrum (1999) proposes several methods. To make teachers feel comfortable, the researcher suggests that training programs be provided in a classroom setting where teachers know it will work. A cognitive *apprenticeship* model of teachers helping teachers is also an effective way, in which schools and districts can build up a long-term support relationship by providing trainings such as specific focused workshops followed by time spent observing and working with a colleague educator comfortable using technology.

Under the impact of the cultural change, infusing technology into the curriculum is indispensable. Teachers must recognize the magnitude of the change in order to adapt willingly. It is a trustworthy experience for any major changes to be successful that there must be a focus on the people first and the innovation second. In adapting the change, we also need to understand that institutional support must be closely followed. It is crucial for teachers, especially in the toddler stage, to meet success in their initial forays into the realm of the digital world (Scoolis, 1999). When teachers feel supported, safe, and know where to go for help, their willingness will sustain and the process of the role readjustment can become smooth, the efforts effective, and the outcomes fruitful.

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The Role of Intelligent Tutoring Systems in Education: An Overview of AutoTutor

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Abstract: Intelligent Tutoring Systems have become more common in education nowadays. AutoTutor is one such system. It uses a world knowledge representation, natural language processing, production scripts and a conversational interface. By assisting students in actively constructing knowledge, AutoTutor shows close to natural didactic and conversational skills. Not only is the system beneficial for both students and teachers, it also helps to test hypotheses in various interdisciplinary fields and generates various new research questions, thus playing an important role in education.

Intelligent Tutoring Systems use intelligent computer-assisted instruction (Graesser et al., in press). They communicate with the learner by keeping a record of what knowledge the learner has and what the system needs to teach. Tutorial strategies applied by the system bridge the gap between the learner's knowledge and the expert knowledge. Over the last few years various systems have been proposed and implemented. One such system is AutoTutor.

AutoTutor assists students in actively constructing knowledge by holding a conversation in natural language. A dialog manager coordinates the conversation that occurs between the system and the student. The manager analyzes the input at a linguistic and a discourse level, in order to determine the right tutoring strategy and responds by using synthesized speech, facial expressions and some rudimentary gestures. At least four components can be distinguished in the system (Graesser et al. 1999).

1. *World knowledge representation*: Understanding natural language requires world knowledge. AutoTutor uses a statistical representation of a large body of world knowledge, called Latent Semantic Analysis. It uses singular value decomposition to reduce a co-occurrence matrix of words (or documents) to a cosine between two vectors. AutoTutor uses LSA to give meaning to a student answer and to match that answer to ideal good and bad answers.
2. *Natural language processing*: Although semantics forms the backbone of language understanding, support is needed from other linguistic information like syntax and pragmatics. AutoTutor uses a dialog management system guiding the student through the exchange and accommodating any student input. Fuzzy production rules and a Dialog Advancer Network form the basis of these conversational strategies. A syntactic parser analyzes the input, translates it in a speech act, in order to predict the structure of AutoTutor's response. In addition discourse markers and dialog history are used to provide the student with a natural conversation. These various components allow for a mixed initiative dialog.
3. *Production scripts*: For its didactic skills AutoTutor uses curriculum scripts, loosely ordered sets of skills, concepts, example problems, and question-answer units. Like most human tutors these scripts follow a macrostructural organization of the tutorial. This allows the tutor to keep track of the topic coverage and follow up on any problems the student might have.

4. *Conversational interface*: Although there is no concluding evidence that a talking head has didactic benefits, there is evidence that students prefer interacting with a human-like tutor instead of text. Since AutoTutor accentuates both conversational skills in addition to didactic skills, it uses a talking head with facial expressions and synthesized speech. Parameters of the facial expressions are generated by fuzzy production rules.

Initially AutoTutor was developed for computer literacy. Evaluations of AutoTutor, using the system as a tutor in a computer literacy course, showed gains in learning and memory compared to control conditions. These results are on par, if not better, than gains in normal human tutoring. Furthermore, evaluations of AutoTutor's conversational smoothness and pedagogical quality of dialog moves also support the claim that AutoTutor is a good simulation of human tutors (Graesser et al, in press).

AutoTutor was designed to be reusable for various knowledge domains. That is, its modular structure allows for domain specific adjustments, without reconstructing the general components of the system. Recently AutoTutor was transferred from the computer literacy to the physics domain. Only two of the modules needed to be changed for the new subject matter: the curriculum script and the LSA space. With the exception of domains that require mathematical precision and formal specification, the system can become an expert tutor in many other tutoring domains within a reasonable amount of time.

We can learn a lot from Intelligent Tutoring Systems like AutoTutor. Testing research hypotheses using a computer model is easier and more reliable than using a human tutor. Various research questions are generated by observing students' conversations with AutoTutor. What kinds of questions are usually asked by students? Can a student's performance been measured by his/her language use? How can we classify various misconceptions and what is the best way to deal with them? Are certain linguistic features used more often in certain fields? To all of these and other questions we have found (or are in the process of finding) answers. These would help the future development of AutoTutor, and education in general.

With a system that shows close to natural didactic and conversational skills, that can be used in a range of domains and that can work at any time at any day for an unlimited period, AutoTutor seems to be the ideal teacher. With the current developments in artificial intelligence, cognitive science and computational linguistics, the question can be raised whether systems like AutoTutor do not pose a potential threat to teachers, tutors and educators. The answer is simple. The current versions of AutoTutor, despite their promising results in evaluations, are far from 'human', and it seems likely that future versions will not fully master a tutor's social skills, pragmatics, gestures and emotions. Nevertheless, when viewed as a prosthesis, AutoTutor can be extremely beneficial. Furthermore, with an increasing demand of literacy and thinking skills at high school and college level, which have hardly improved over the last thirty years (RAND, 2001), additional educational means are welcomed. Intelligent Tutoring Systems like AutoTutor could play exactly this role.

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Supporting classroom discourse with technology

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Abstract: In this work we studied the impact of using NuCalc, a computer algebra software, on the development of a discourse community in a college level mathematics class. We examined: the influence of technology on group interactions; the influence of technology on mathematical investigations of learners; and the influence of technology on teacher's interactions with students. Data points at 4 distinct ways in which the presence of technology positively influenced the learning community we studied. These were: l) technology as a tool for extending mathematical thinking, (2) Technology as a tool for motivating engagement in group discourse, (3) Technology as a tool for regulating discourse, (4) technology as a tool for refining the culture of classroom.

Introduction

In this research, we examined the relationship between technology enhanced mathematics instruction and group discourse. We analyzed the content and structure of the interactions among a group of prospective secondary mathematics teachers, and whether the presence of technology mediated their mathematical discourse. We addressed three research questions:

What affect does the presence of technology have on the quality of peer interaction?
Do more complex patterns of mathematical discourse arise in the presence of technology?
What influence technology has on the teacher's interactions with students?

Participants and Instruction

The participants were 16 college students enrolled in a senior level mathematics course designed for undergraduate mathematics majors and minors seeking a certification in either middle or secondary teaching. The group composed of 6 female and 10 male students.

The faculty member teaching the class was an experienced mathematician and mathematics educator. Her teaching philosophy matched the goals of reform. The activities used in the current study motivated reasoning, perspective taking, and problem solving. The problems required students to make mathematical generalization using both deductive and inductive reasoning. The use of technology in solving these problems neither reduced the integrity of the mathematics involved, nor led students to immediate answers.

Procedure

Data was collected over a period of 3 weeks. Participants met twice a week. Each class session lasted 75 minutes. During the first two class sessions (phase I data collection) we collected baseline data on the quality of mathematical discussions students had. During the 3rd class period, the instructor introduced the NuCalc software (Pacific Tec 2000). During the second phase of data collection, the last three class sessions, the students discussed specific explorations. The whole group discussions were used as the data source

Findings

Our results points at 4 distinct ways in which technology influenced the learning community we studied. These are: 1) technology as a tool for extending mathematical thinking, assisting peers in constructing more sophisticated mathematical explanations, (2) Technology as a tool for motivating engagement in group discourse, increasing peer participation and engagement in group inquiry, (3) Technology as a tool for regulating discourse, (4) technology as a tool for refining the culture of classroom shifting the patterns of interactions between the teacher and learners.

Technology as a tool for extending mathematical thinking: In this work, we assumed that technology would allow room for group construction of knowledge as individuals interact with each other and with technology to develop a shared understanding of problems, and of their solutions (Cole 1996). Indeed, for the participants in this study convergence on both was facilitated by technology.

Technology as a tool for engagement in discourse: In addition to providing students with a cognitive tool for constructing mathematical arguments, technology served as an affective tool for both intensifying and amplifying group discourse. It allowed less reluctant participants enough confidence to enter soci-mathematical interactions in ways that was not possible to them before. In its presence both participation and engagement in problem solving activities and group discourse was increased. This was particularly evident in the significant change we detected in the number of volunteered participation at the two phases of data collection. While during the first phase only 3 students regularly volunteered answers, during the second phase approximately all students were simultaneously involved in sharing and exchange of ideas.

Technology as a tool for mediating discourse: Technology helped structure group discourse by organizing and constraining peer interactions. The participants used the available technology to construct a shared conceptual space as they relied on immediate feedback structure of the system to negotiate meanings and to build and share their basic mathematical assumptions. They frequently produced visual displays to reflect their intermediate understanding of problem and of peers' comments and to test each other's assertions. In the process they either confirmed, or adjusted their own understandings as well as their peers'. This was reflected in the significant increase in the number of times they used technology to communicate their thinking, referred to technology based evidence to convince peers, the amount of time they spent on analyzing problems, and the amount of time they spent explaining their responses. These processes led to the construction of more sophisticated mathematical arguments by the group members.

Technology as a tool for refining the culture of classroom: In this case study, an obvious impact of the use of technology was increased student commitment to mathematical problem solving, and to knowledge sharing. This led to a natural transition of the locus of control in the classroom. While initially, the instructor was the one who shaped and guided the verbal exchange in class, her presence was not as visible when students used technology to verify statements, and to counter or support arguments. During the sessions that the technology was present she felt little need to encourage participation, the students were initiating more arguments themselves and volunteering explanations to peers. The increase in participation and engagement facilitated the transition of authority from the teacher to students. The shifting relationship was manifested in the decrease in the frequency of the teacher's intervention during their problem solving sessions.

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We are Ready but are We Effective?

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Abstract: This is a report of a study that was conducted to determine if the newly developed planning strategy could be helpful for online course development in Workforce Teacher Education programs at University Council for Workforce and Human Resources Education institutions.

Introduction

In the new educational paradigm, computer and information technologies were the means to change the activities, interaction, and relationship between online educators and students, as well as among students. With proper planning and use, computer and information technologies could empower online educators' creativity and students' responsibility for their own learning. Moreover, the incorporation of computer and information technologies into the educational setting had shown to improve students' abilities to be self-directed learners (Dede, 1997). Computer technology could help students to be more motivated, feel that they exercise control over their learning experiences, and become accountable for their own learning outcomes. Computer technology could serve as a catalyst to transform teaching and learning, and to expand learning productivity and possibilities.

Future education needs effective programs in order to keep up with the new challenges and dynamic evolution of knowledge, computers, and information technologies. Online programs, especially, could be much more affected by these matters. Therefore, a systematic planning approach to properly guide online educators for the development of online courses was needed (Glasgow & Seels, 1998).

Distance learning opportunities that were possible through flexible and dynamic delivery technology had increased the number of students attaining academic degrees. This emerging phenomenon had influenced more university officials to encourage their faculty to convert more traditional courses to online courses or other forms of distance education techniques. Many faculty welcomed the opportunity to use new technologies for delivering their courses, but many of them also resisted this effort for various reasons (Dede, 1997).

In the traditional classroom environment, students and educators had the opportunity to simultaneously and spontaneously interact and communicate face-to-face between and among themselves. However, in online classes those possibilities were limited for various reasons. Class communication and interaction were dependent on the types of technologies used. Also, it was critical to utilize various forms of instruction strategies that were allowed by the new technologies.

Wagner and McCombs proposed three effective guidelines for designing instruction. Those guidelines were: (a) the opportunity for students to operate holistically; (b) students' individual perception and evaluation should develop their behavior; and © students' overall development should be a dynamic growth process. These guidelines showed that online learning was suitable to be utilized for improving teaching and learning, especially when students were central to the education processes.

Online educators were faced with challenges of converting traditional classroom activities to online class activities (Simmons, 2000). The ability of the online educators transferring and transforming traditional class activities to online activities without affecting students' concentration, motivation, thought, mastery, and comprehension was critical. Online educators were also expected to deliver the same quality of education as the traditional class in order for online teaching to be accepted as a future main stream of education delivery.

Purpose of the Research

Currently, university faculty are exposed to many forms of online delivery tools such as e-mail, listservs, web pages, chatrooms, threaded discussion, desktop conferencing, digital multimedia, and other. These opportunities might allow faculty to use an online format to deliver their classes. However, there were other reasons faculty delivered classes online. They were encouraged or mandated by the universities or were voluntarily experimenting with the new delivery approach. Some faculty used a complete online format of delivery whereas others incorporated and integrated various forms of delivery technologies. The purpose of this study was to determine if the planning strategy could be helpful for online course development for the faculty in Workforce Teacher Education (WTE) programs at University Council for Workforce and Human Resources Education (UCWHRE) institutions.

Analysis of Data

The following analysis of results was obtained upon completion of the study.

1. Distance education faculty of various backgrounds have the perception that a systematic planning for an online course does not follow the assumption that the sequence of the elements must be ranked in the same order of importance of the elements of the strategy;
2. The key to effective online classes is to have a good planning strategy – properly sequenced, that encompassed several elements that are important to teaching and learning.
3. The faculty of different distance education experiences – number of years teaching and number of distance classes conducted; (a) were equally skilled and capable to systematically plan online classes development; and (b) were aware of the important elements that should be considered for planning of online courses.
4. Most of the faculty that are currently delivering non-computer based distance classes are equipped with the skills and experience of the basic online class delivery tools (e-mail and web-based);
5. Faculty may have little or no difficulty to deliver online classes if proper training is given, online delivery software are user-friendly, and the supports needed are provided;
6. New faculty seems to be more likely to get involved in a new approach of a teaching format when compared to the seasoned distance education faculty
7. Different experiences, skills, and knowledge pertaining to distance education did not influence new and seasoned distance education faculty who utilized various forms of distance delivery tools to have different opinions on the sequence of a planning strategy for online courses;
8. Different experiences, skills, and knowledge dealing with distance education would lead new and seasoned distance education faculty to have different perspectives on which of the planning elements are more important for online course development process.
9. The distance education faculty in this study are aware that: (a) a systematic approach is important in planning and designing their online classes; (b) if this strategy is utilized properly, it should influence online/distance course planning and designing; (c) this planning strategy is important to initiate the effort of converting traditional class and other forms of distance classes into online courses, especially when the faculty showed strong agreement that online delivery will become the future mainstream of education formats; and (d) the strategy is also suitable to be utilized as its' own planning strategy to transfer the existing traditional course into a complete online/distance course or for integrating traditional and online/distance classes.

Conclusion

Faculty that participated in this study highly agreed that online or distance courses would become one of the mainstream education formats in the future. They also indicated the developed strategy would influence their planning for online or distance courses. Finally, most of the faculty were found to be familiar with some forms of online delivery tools.

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The Effects of Computer Use on Intrinsic Motivation for Continued Study of a Content Area

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Abstract: This pilot study examines how grade 3 and 4 educators may improve motivation though computer usage. By using computer-assisted instruction in a primary subject area, a teacher can encourage students to choose to work in a subject area they previously disliked. The findings of this study are based upon classroom observations conducted during a two-month period.

Students in a mixed 3rd and 4th grade classroom participated in this study. A general measure of motivation indicated that the students preferred a challenging learning environment to other conditions. Furthermore, when the computer was used to present age-appropriate challenge, students were engaged in previously objectionable content areas with few complaints.

Getting the students to recognize that using quality software programs is "fun learning" rather than "fun" or "learning" remains a goal for educators to pursue. Computer usage combines the students' desire for challenge with the their quest for control.

Introduction

What type of technology-based instruction enhances student learning? What type of motivation do educational computer games provide -- intrinsic, extrinsic or both ? How much of the content area learning that a child experiences while playing a computer game stays with the child when the session of computer use is over? If researchers can determine how computer use may motivate a child to learn more content area knowledge, another piece of the educational puzzle will be revealed.

The majority of instructional software has typically been of the drill-and-practice variety (Alessi and Trollip, 2001). While these games are efficient at their tasks, they do not seem to encourage higher levels of cognitive processing. There are, however, several programs that have enjoyed both awards from educators and commercial success. Some of these programs contain some drill sections, but all of them go beyond that capability and engage students in high level cognitive processing. The programs examined in this study capture and maintain children's interest (*Only the Best*, 1999-2000).

Questions about software programs remain. How does software maintain student interest? Is the fun factor the de facto reason for motivation? Should we equate the child's response that a game is fun with the assumption that fun means intrinsically motivating? Or is it possible that "children may be intrinsically motivated to play and win a game, but still be extrinsically motivated to learn school content" (Alessi, personal correspondence)? If we measure intrinsic motivation as the desire to continue studying the same subject matter after playing a game, how much evidence of intrinsic motivation are researchers likely to find?

Literature

Research supporting the positive effects of computer use exist, yet many studies also indicate that the effects are difficult to measure (Kulik and Kulik, 1991). Positive attitude, which may be interpreted as motivation, is one of the most indicated effects of computer use (Kulik and Kulik, 1991). Thus, motivation may provide a measure for examining effects of computer game usage in education. Commercial computer game makers design primarily for motivation, and they are successful in keeping students interested for the approximately 25 hours that it takes to complete a commercial game. A precedent of designing for motivation has been set by commercial game companies, and positive student attitude toward any type of K-12 computer use shows a inclination that may be exploited. High-quality educational computer games could use the motivation factor as a natural lead-in to academic success, perhaps through the related constructs of student choice and desire for challenge.

In terms of subject area achievement and use of computers, games for teaching the content area of math seem to have the greatest results (Katz and Offrir, 1996; Randel, Morris, Wetzel and Whitehill, 1992). The drill-and-practice necessary for mathematics learning seems to lend itself well to computers, because drill-and-practice takes full advantage of a computer's ability to perform a task repetitively. Other areas have produced promising effects as well, when some aspect of the subject matter can be presented in drill-and-practice form, for example in the example of language arts grammar (Randel et al., 1992).

Educational computer games should meet the instructional design motivation criteria as described by Malone: games should incite curiosity, give challenge, stimulate fantasy and provide user control (Lepper and Malone, 1987; Malone 1980, 1983). Others cite challenge and control as the two most important factors (Hanna, Risden, Czerwinski, and Alexander, 1996).

The instructional design definition provided above lacks a few elements covered in the general area of motivation. This area has been researched from many aspects and includes aspects of motivation measuring such as level, orientation, trait or state. Although this study examines the intrinsic versus extrinsic difference, it is important to acknowledge that extrinsic motivation is not always a poor substitute for intrinsic motivation, particularly when the student has accepted the extrinsic motivation with a sense of "volition" (Ryan and Deci, 2000). The high performance level executed by a student with volitional choice is likely to encourage additional work at the same level (Zimmerman, 1998). In addition, the research may indicate that some other type of motivational factor is at work.

Motivation changes with time while playing games (Westrom and Shaban, 1992). An area related to motivation is interest. Interest also has several varieties, and it can be long term, situational or even shorter (Hidi and Harackiewicz, 2000). Like motivation, interest runs along a time continuum (Hidi and Harackiewicz, 2000).

Choice is another factor in motivation. Generally, choice is found to result in positive affect but with little or no performance impact (Flowerday and Schraw, 2000). It has been hypothesized that performance should be removed from the equation when measuring effects of choice (Hidi and Harackiewicz, 2000). All together, computer-assisted instruction seems to have a history of increasing student motivation overall. This study will examine whether the motivation can be channeled to have a particular result.

Design

The mid-western school where this study took place reflects the heterogeneity of the large university nearby. Its ethnic composition may be attributed to the fact that many of the parents are affiliated with the university in some capacity. While more than 75 percent of the population was Caucasian, the other ethnic groups represented include various African groups, African-American, Chinese, Japanese, Iranian, Korean, and Russian. Ability levels were heterogeneous as well.

One self-contained third and fourth grade classroom was selected for participation in the study. This group is both highly vocal about their opinions and inquisitive in nature. This age level has mastered some basic skills, but could clearly benefit from additional practice of elementary knowledge. This age group is characterized as having good self-esteem, fair reading and writing ability, some logic, and high academic goals (Howe, 1993a and 1993b; Newbill and Clements, 2000). The teacher of this group was supportive of using technology in the classroom, but had moderate experience in technology integration.

Software used was Edmark's Thinkin' Things series, The Learning Company's Reader Rabbit series, and Broderbund's Carmen San Diego series, representing science, reading and math, respectively. These software titles were also chosen because they are slightly less available as local off-the-shelf purchases than the KnowledgeWare's JumpStart series, for example, and they were critically acclaimed by educators (*Only the Best*, 1999-2000). Motivation may be better measured if the student is not overly familiar with a program, and certain programs such as the Jumpstart series are more likely to be used in student homes. Furthermore, at least one program, the Carmen San Diego series, highly encourages offline uses (Druin and Solomon, 1996). The Learning Company's Cluefinders series was considered as an alternate program.

The researcher was introduced to the classroom as a classroom observer who would visit over a two-month period. First, she randomly assigned students to one of three groups, representing the groups learning with science, reading, and math software. She took pre-experimental measures during the first week. For example, the students were given the Harter Extrinsic-Intrinsic Motivation in the Classroom Scale, a self-report inventory where the scale measures whether students generally feel empowered in the classroom or whether the students attribute their success to external factors. The information from this instrument was compared with student actions during the study. Finally, the researcher offered the students a choice between a science, reading, or math activity on two occasions during that week and the choices were noted. This part of the study took approximately one week.

For the approximately 25 hours each, the children played one instructional game exclusively, effectively becoming an expert at playing that one game. In addition to the two computers available in the room, the researcher added three computers to the classroom, with the software installed on each one. Interview questions after this part of the study revolved around what the student believed he or she had learned about that particular subject.

The week before the last week of the study, students were allowed to choose an instructional activity in one of the three subject areas. Student choices were carefully noted during this time as the student's choice was the dependent variable of this study.

The final week of the study consisted of asking exit interview questions. Finally, the teacher was interviewed for his or her opinions on each student's motivation in the subject matter prior to and after the intervention.

The researcher recorded the answers to interview questions on audio tape and wrote short versions of the students' replies on a paper copy as a backup to the audio-taped discussions. The following items were recorded on a separate sheet for reference: the gender, grade, and age of each subject along with the student's assigned number and real name. She also monitored the subjects' behavior through the use of a tally sheet. The notes on the tally sheet included: the day number of the study, the minutes the student spent using computer game, whether the student played the game alone or with partners, and any particular choices the student made that were relevant.

Information was analyzed in several ways. First, it was noted what choices predominated for both the self-identified intrinsically and extrinsically motivated groups. Then, interview responses and observation comments were reviewed seeking themes among groups of students.

Findings

Some students did not voice a choice of one subject area over another at the beginning. However, mathematics was most often the stated favorite and the chosen activity. Students, in general, said they enjoyed the educational software. The teacher agreed that the students were definitely motivated on days when they used the computer. These findings repeat what previous research has found about high student satisfaction levels and early motivation when using computers (Kulik and Kulik, 1991).

During open-ended interviews, students most often commented that the experience was "fun." However, only one student referred to the experience as a learning one. A few mentioned the challenge of the programs, sometimes through related phrases such as enjoyed "figuring it out" and "solving problems".

The predominance of these types of phrases demonstrate how students truly prefer to learn. A number of related positive comments are in table 1.

Comment	Number of students expressing thought
"Fun"	5
Felt "challenged"	3
Enjoyed "figuring it out"	3
"Liked" it	3
Enticed by "new games"	2
Could "solve problems"	1
Did "cooler stuff"	1
Did "experiments"	1
Did "something"	1
Did not do "too much of the same thing"	1
Hadn't "done [it] before"	1
"Learned a lot more"	1

Table 1. Student comments about the best features of their computer-based learning experience (n=15).

Students want to feel productive. They enjoy the accomplishment which accompanies game playing. Two students expressed the idea that "I'm good at it" and one replied that it was easy to do.

Providing a choice to the students at the end proved interesting but not conclusive. The students expressed the desire to choose, but when faced with a choice most just wanted to experiment. As for the initial questions vis-à-vis motivation toward a certain content area, students tend to restate the favorite subject after the intervention.

Discussion

Looking for ways to measure the computer's effects on content area learning helps educators meet the need to know when and how to integrate this technology. Using computers in classrooms to encourage interest in otherwise uninteresting tasks may be a use that educators will actually perform.

This pilot study addresses the problems of educational messages "going flat" and the "educational label" being misconstrued (Tyner, 1998). These problems are avoided when learning remains fun. Computers in education can be used for the purpose of sustaining interest and motivation. The challenge is in shifting children's views to thinking that the computer work is just fun not work that is fun. Schools need to pursue technology use in more carefully considered ways. Those who promote educational technology should design plans which offer more seamless integration to teachers and some choice for students.

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A National On-Line Survey of Education Faculties Use of Technology in Perservice Teacher Education Courses

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Abstract: This paper reports the results of a national on-line descriptive survey. Eight hundred and eighteen teacher education faculty members' affiliated with schools, colleges and departments of education (SCDE) from 50 states reported how they used educational technology in preservice teacher education courses. Five research questions were utilized to determine whether there was a relationship between the dependent variables *(DV)*, teacher education faculty members' proficiency *skill* levels using educational technology in education courses and the independent variables *(IV)*: Technology planning; professional development; redesigning courses for technology integration; assessment and evaluation; and issues related to classroom diversity, equity and equal access of technology. Several low to moderate correlations were found significant at the .05 probability level. Survey respondents reported positive attitudes toward the use of technology and valued it as both a cognitive an instructional media. Technology access, support, time and training were identified as major barriers to technology use.

Introduction

In the 21st century America's economic success will depend on a well-educated population that can contribute to a modern, technologically complex workforce and global economy (CEO Forum on Education and Technology, 2000; Fulton & Pruitt-Mentle and 1998; Gates, 1999). Consequently, as the United States adapts to the needs of the new millennium and the nation seeks to assure educational success for all students, it is imperative that new educational programs, tools, and methods to educate American pupils be continuously identified and implemented. Educational technologies have been identified as effective cognitive and instructional media tools, which numerous scholars, policy makers, educators, parents, and business leaders continue to promote and endorse as potent teaching and learning tools in kindergarten to grade 12 (K-12) and in institutions of higher education (IHE). According to Houghton (1997), Means (1998), Plotnick (1996), due to the rapid changes created by technology, a systematic restructuring of schools [and IHE] based on the needs of an information society is required. Moreover, it is accepted and expected that educators will utilize educational technologies in the classroom to prepare new teachers and students to live and work in the new digital age (Abdal-Haqq, 1995). However, Cuban (1999), Green (1999) and Willis (1997) agree that our current education system continues to prepare students in schools designed to meet the needs of an information-static industrial age. Consequently, installing technology in [k-12] schools and [IHE] has done little to promote the kinds of changes that meet the needs of a 21st-century classroom.

Additionally, Abdal-Haqq (1995), and others have identified several factors, which have conspired to produce the expectation (and in some instances the requirement) that today's K-12 teachers and (SCDE) faculty members' possess among their qualifications the ability to utilize computer-based technologies. These factors include: (a) the need to provide relevant and authentic instruction that reflects contemporary and future social, political, and economic demands on students (Trotter, 1998); (b) the compatibility of certain computer-based technologies with newer, research-based approaches to teaching and learning (Gardner, 1995; Gates, 1999; and Office of Technology Assessment [OTA], 1995); (c) student and parent expectations (Goals 2000); and (d) guidelines and mandates from federal, state, and district government agencies, professional bodies, and American business leaders (American Association of College Teacher Education [AACTE], 1998; Gates, 1999; International Society for Technology in Education Accreditation Committee [ISTE], 1996; National Council for Accreditation of Teacher Education [NCATE], 1998b). Due to the laggard pace (SCDE) have taken in adopting technology, improving their performance in preparing technologically proficient teachers will require expanding technology use among teacher educators

(Mcnergny, 1996). Houghton (1997) and others, identified several obstacles to infusing technology into teacher education programs: (a) limited availability of equipment, (b) lack of faculty training, (c) no clear expectation that faculty will incorporate technology into academic activities, (d) lack of funds, (e) lack of time to develop faculty in using equipment and software, (f) doubt about the pedagogical validity of using some of the newer technologies since the appearance of literature about these tools is relatively recent, (g) lack of technical support, (h) lack of appropriate materials (particularly integrated media materials suitable for teacher education instruction), and (i) the absence of clear programmatic goals for the teacher education program as a whole. According to Schmidt (1995), in order to plan effective educational technology programs for teacher education faculty members' there exist a need to document current levels of educational technology use among teacher education institutions nationwide. Thus, the purpose of this study was to ascertain how teacher education faculty members' at SCDE from 50 states used educational technology in preservice teacher education courses to improve teaching and learning in K-12 learning environments.

The Study

The sample population for the study was approximately 818 teacher education faculty members who had electronic mail (e-mail) addresses and who provided instruction to preservice teachers. The respondents were randomly sampled from 50 U.S. states at SCDE affiliated as member or non-member institutions of the AACTE and NCATE, and the AERA. They were asked to complete an on-line survey utilized to collect data. A major part of the *Educational Technology Survey's (ETS)* 48 items were based on a 5-point Likert scale. The instrument was designed by the researcher based on a selected review of the literature (Becker, 1995; Good, 1997; Green, 1999; Lan, 1997; Likert, 1932; Moursund & Bielefeldt, 1999; Schmidt, 1995). The survey participants were randomly selected from several lists of Internet-published electronic mail (e-mail) addresses located in professional education directories, SCDE (e-mail) addresses, or affiliated teacher education Internet listservs. The respondents received an e-mail message with information about the study and an Internet URL link address; *a website homepage where the survey was located* which guaranteed anonymity and invited them to voluntarily complete the survey.

Returned surveys were coded and the data entered into data files using two software applications: (a) *Survey Systems*™ (Creative Research Software, Inc., 1999), and (b) *NCSS 2000* (Hintze, 2000) statistical software. Descriptive statistics were utilized to describe the survey respondents' general characteristics. Chi-square analysis were performed on nominal and ordinal measures. Correlation coefficients were analyzed using two statistical tests for nominal and ordinal data: (a) Spearman's Rank Correlation Coefficient and (b) Kruskal Wallis statistical test. These tests were used to determine the relationships between the (DV's); teacher education faculty members' technology proficiency *skill* levels using hardware and software and the following (IV's): Technology planning and infrastructure components; professional development and faculty technology training; redesigning courses for technology integration; classroom diversity, equity, and equal access of educational technology use; and assessment and evaluation of educational technology use in preservice teacher education courses and during preservice teacher candidates' field experience and demographic variables.

Findings

Due to the large amount of data collected only the most important findings will be reported. The population for this study was 888 randomly selected teacher education faculty members from schools colleges and departments of education (SCDE) from 50 states. There were 818 usable surveys, which constituted a response rate of 20.0%. An analysis of the respondents' demographic characteristics revealed that 46.0% of the respondents were male and 54.0% were female. The largest percentage of respondents fell within the age group 46 to 55 years. The largest racial ethnic group was Caucasian/White, which represented 86.4% of all respondents. In reference to teaching credentials offered, 68.7% of the SCDE offered graduate teaching credentials and 84.0% offered undergraduate teaching credentials. In terms of teaching skills, 43.7% reported K-12 experience and 52.7% reported higher education experience. Eighty-one percent held doctoral degrees and 14.9% held master's degrees. Most teacher education faculty members taught a variety of courses. Approximately 40.7% reported teaching graduate courses, followed by 39.6% teaching education methods and 30.6% teaching field experience courses. Of the 673 respondents who completed Question 45 of the survey, 93.9% reported home computer ownership.

Nearly 60% of the respondents reported that their SCDE did not have a written technology plan that is updated annually and included national technology standards. Fifty-two percent of the respondents reported that their technology plan did not include a faculty technical assistance team. Sixty-seven percent reported conflicting information about how their education departments address issues related to classroom diversity equity and equal access, and nearly 64% reported that teacher education faculty members did not evaluate the impact of technology use on teaching and learning. Nearly 56% of the respondents reported that their education departments did not conduct faculty training needs assessments annually. Fifty-nine percent of the respondents reported high proficiency skill levels using the following hardware equipment: The microcomputer, CD ROM player, and the modem. Nearly 81% of the respondents reported high proficiency skill levels using the following software applications: word processing and Internet search engines.

More than half of the respondents reported negative attitudes related to educational technology use and rewards and incentives offered by professional development programs at SCDE nationwide. Sixty-four percent reported that their SCDE professional development programs did not connect tenure and research to technology use. Fifty-one percent reported that their education departments did not offer research opportunities related to technology use. However, over 51.0% reported that their education department offered release time to attend technology related training activities. Fifty-six percent of the respondents reported that they did not believe that education faculty members use educational technology to address multiple learning styles. Fifty-four percent reported that they believed teacher education faculty use educational technology to address the expectations of school districts. Fifty-six percent of the respondents reported that their education departments did not support the use of educational technology by offering state-of-the-art technology training models. Sixty-four percent of the respondents reported that education faculty members use educational technology as a cognitive tool and 75% reported that faculty use technology as a instructional media tool to enhance teaching and learning in the classroom.

Seventy-two percent of the respondents reported that their education department assesses preservice teacher education candidates' use of educational technology during course work. A majority (62%) disagreed that preservice teacher education candidates are required to demonstrate mastery of educational technology use during field experience. Sixty-five percent disagreed that teacher education faculty members monitor preservice teacher education candidates' use of educational technology during field experience. Nearly 63% of the respondents reported that teacher education faculty did not evaluate the impact of educational technology use on teaching and learning. Sixty-seven percent of teacher education faculty members reported that their education department addressed issues related to classroom diversity equity and equal access of educational technology use in preservice teacher education courses. However, on a similar question that was designed to elicit the respondents' attitudes about classroom diversity and equity issues and technology models, which incorporate national technology standards, the results revealed that nearly 60% of teacher education faculty members disagreed with the statement.

The data results revealed that males reported and obtained significantly higher mean scores using educational technology hardware and software, had more positive attitudes than females toward hardware technology use in preservice teacher education courses, and used these technologies at a higher percentage rate in the classroom than female teacher education faculty members. In addition, males obtained significantly higher mean score ranks on all educational technology software items except word processing and desktop publishing. The 30-to-39 age group reported and obtained higher mean scores, had more positive attitudes toward hardware technology use in preservice teacher education courses, and used technology at a higher percentage rate in the classroom than teacher education faculty members from different age groups. The data support a positive correlation between the age group 30 to 39 and high software proficiency levels for the five software items listed. The data appear to indicate that a new younger generation is better prepared to use certain educational technology software and hardware in teacher education courses. The group that obtained the lowest mean score ranks for all 10 software items was the over-56 age group.

The data revealed a strong positive relationship between home computer ownership and high scores for *hardware* proficiency skill levels and a strong positive relationship between home computer ownership and *software* proficiency (skill) levels for nine items. Respondents who reported teaching technology courses obtained higher mean score ranks for all 11 *hardware* items and higher mean score ranks for 8 of the 10 *software* items. The second highest mean score ranks were obtained by respondents who reported teaching education foundation courses, and the third highest mean score ranks were obtained by the respondents who reported teaching education methods courses. The lowest mean score ranks for many of the items were obtained by respondents who reported teaching curriculum and other courses. These data appear to indicate a strong positive relationship between types of courses currently teaching and software proficiency (skill) levels for eight items.

Conclusions

Low to moderate correlations was found between several of the IV's and the DV's, significant at the .05 probability level. Survey respondents reported positive attitudes toward the use of technology and valued it as both a cognitive an instructional media. Technology access to equipment, support and training were identified as major barriers to technology use. The results of this study identified the infrastructure, teacher education faculty members' attitudes toward the use of educational technology, training needs, and effective teaching methodologies for technology use in teacher education courses. Guidelines for teacher education programs and school districts can be established using the current research model to provide: (a) skill training and professional development of faculty members' and new teachers; (b) address issues related to classroom diversity, equity, and equal access of technology; (c) provide a theoretical model to redesign teacher education courses and programs and (d) assess and evaluate model technology programs.

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Stakeholder Perceptions of the Use and Value of Computers and Technology in an Elementary School Setting: A Case Study of the Vision and Reality of Educational Technology

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Abstract: The purpose of this study was to describe the status of classroom computer use at an elementary (K-6) school with a population of 676 students in a rural county in the mid-south. A further purpose of the study included examining and describing the patterns of beliefs or attitudes toward the use of technology in education and the skill levels necessary for use. Teachers, administrators, and parents within one school were observed and surveyed offering qualitative and quantitative data in order to make recommendations regarding the direction of technological development for the school and determining the types of training needed.

Introduction

By examining one school as a case study, it is possible to probe barriers to and facilitators of technology use. To understand the strengths that support effective technology use in education, and learn about the weaknesses that may inhibit the effective use of technology as a learning and teaching tool, one might examine a school's expenditures on technology, technology use by teachers, and attitudes of parents, teachers, administrators, supervisors of instruction, and technology coordinators regarding technology use. Do teachers feel adequately prepared to integrate technology in the state-mandated curriculums? What effects do teachers' beliefs regarding the importance of technology have on the way they use technology in the classroom? What similarities or differences appear in expectations relating to technology use in the classroom held by teachers, by administrators, and by parents and how might these similarities or differences effect present or future uses of technology in the classrooms?

Teachers and Technology

Research indicates that teachers must use computers competently in their classrooms, both as vehicles of pedagogically sound instruction and for classroom management. They must have knowledge of hardware and software applications (Hardy1998; McNamara1995; Siegel 1995; Walters 1992). However, Rosenthal (1999) sites a survey done by the National Center for Education Statistics (NCES 2000-003) finding that only 20 percent of the nation's 2.5 million public school teachers feel comfortable using technology in their classrooms. Another recent NCES brief (2000-090) elaborates that 13 percent of all public school teachers with access to computers or the Internet at school feel not at all prepared; 53 percent feel somewhat prepared; 23 percent feel well prepared and 10 percent feel very well prepared. These findings underscore other research (Siegel 1995; Schrum 1999; Strudler & Wetzel 1999) which indicates that even if teachers hold positive attitudes toward technology, the lack of time, access and support needed for teachers to feel competent in using technology in instruction may keep teachers from becoming comfortable with technology in their classrooms.

Poole & Moran (1998) suggest that limited and/or inadequate staff development prevents teachers from utilizing existing technology in their teaching. The authors continue stating, "One-shot workshops, added expense of training, lack of continued support, isolated knowledge, unawareness of school needs, lack of knowledge and support from leadership all contribute to the ineffectiveness of technology staff development". Studies show that most teachers do not learn to use computers from taking college courses, attending seminars or workshops, or through traditional inservice programs (Galloway 1997). More continuous training (Hardy 1998) in the use of technology in education over the course of seven years may provide teachers with the experience, comfort, and confidence to successfully incorporate technology into instruction.

Braun (1993) underscores the types of training in technology teachers need as he reports conclusions drawn from research done by the International Society for Technology in Education (ISTE), "Teachers need training in the uses of technology in their curricula; time to develop these uses; and support from their administrators in a risk-free environment – and they need these on a continuing, long-term basis". While many people recognize the need for staff development related to technology, Bailey (1997) states, "Even though there is considerable information about the general characteristics of effective staff-development practices, there have been minimal amounts of information specific to technology staff-development programs".

Wang (2000) utilizes a model published by Lloyd and Welliver (1989) denoting familiarization, utilization, and integration as three phases that provide a framework for computer training for teachers. The focus of the familiarization phase rests on acquainting teachers with computer equipment and terminologies. The utilization phase of instruction involves teachers using computers as personal production tools. Direct integration of technology into the curriculum occurs in the final phase of training. McNamara & Pedigo (1995) discuss a similar training model that follows three basic levels: awareness level, which provides basic knowledge about computers; development of skills level, actual use of equipment and computer software; and application level, integration of computers into curriculum.

Teachers need models to follow when integrating technology into the curriculum. Sherry, Billig, Tavalin, & Gibson (2000) suggest that teachers need mentors, specialists who help guide their understanding of technology, and on-line resources available to them as they attempt to use technology in curriculum integration. This support structure for teachers provides a level of empowerment to the teachers both as learners and as users of technology.

Thornburg (2000) makes an interesting observation as he notes, "Technology is not the point – learning is". In the author's reference to "technological fluency," he suggests teachers should not stop with students merely knowing how to use computers, but teachers should set examples of how to use computers as tools for learning. Poole and Moran (1998) suggest a staff development model called "Teachers Teaching Teachers Technology" (T-4). The plan works on the premise that a team effort toward technology training can promote effective technology learning by teachers. Teachers obtain release time for working to integrate technology into their curriculum and in developing personal technology skills. A team of "experts" from within the school survey teachers for training needs, develop a training schedule of classes, and serve as instructors in those classes. The teachers trained at the initial classes serve as the next level of "experts" when the training session appears next on the schedule.

By contrast, Saul Rockman, (2000) as quoted in Electronic-School believes that teachers should only learn enough about computers to get their work accomplished. He indicates that students would take the lead in using technology if teachers would move aside and give them permission to do so. The technology gap that exists between students and teachers indicates "... students may know more about how to use the technology than adults" (Watson, 1998). Watson, in her research on the how students use information technologies, goes on to suggest the need for more research into how best to assist teachers in using technology to facilitate student learning. *Teachers and Technology: Making the Connection* (1995) developed by the U. S. Office of Technology Assessment, indicates everyone benefits from student and teacher collaborations in using technology as "the K-12 students themselves learn the technology and help their teachers find ways to use it" (on-line version). This notion underscores a resent survey (National School Boards Foundations, 2000) indicating that three out of four teenagers use on-line resources via the Internet.

Weiner (2000) indicates that, based on a survey conducted by Market Data Retrieval, funding spent on teacher training in technology constitutes only a minimal amount of the total budget for technology in public schools in the United States. Of the estimated $5.67 billion spent on technology in public schools during the 1999-2000 school year, only 17 percent went to teacher training.

Training Future Teachers

In reference to encouraging teachers to integrate technology into their classrooms, Dr. Linda Roberts, special advisor on technology to the U. S. Department of Education states, "If you can get teachers to use technology effectively in their own lives, you have won 90 percent of the battle" (Rosenthal, 1999). Rosenthal continues to describe how the National Council for the Accreditation of Teacher Education (NCATE) requires all colleges and universities to train pre-service teachers in how to effectively integrate technology into their curricula as opposed to only offering separate courses about technology. Brush (1998) concurs with this notion as he calls for integrated technology training throughout the teacher education program. Computing instruction integrated throughout the teacher education program, according to Moursund & Bielefeldt (1999) reigns superior over isolated computer classes. Students who receive computer instruction in an integrated manner more naturally integrate technology into the school curriculum as inservice teachers.

Wang (2000) indicates that preservice teachers placed in practicum settings with teachers who view efforts to integrate technology into the classroom as hindrances to routine work will not appreciate the value of computers in education. While much research exists relating to understanding preservice teacher perceptions of technology (Diegnueller 1992), their perceptions of good teaching practices may reflect an obsolete educational system. In a study of preservice teacher perceptions on changing teacher roles and technology, Carr-Chellman & Dyer (2000) asked preservice teachers to respond to a reading on the future vision of education. Results showed that many respondents preferred traditional teacher roles that reflected the same types of teaching methods as they experienced as students. The researchers credit much of this to the notion of "change" in general, independent of the use of technology in education.

Technology Planning

A 1991 policy statement generated from the Council of Chief State School Officers requires that all states develop and maintain written plans for integrating technology in the education curriculum (Improving Student Performance through Learning Technologies, 1991). Anderson (1996) explains that states develop technology plans of a more general nature than district or local school technology plans. The state plans deal with more with non-specific principles, financial support, and issues of district accountability of state funding. District technology plans address the specific needs of a school system and includes an overview of local school technology goals. District plans provide broad outlines of the many aspects of the use of technology in education including administrative concerns, public relations, and other facets of the school system as a whole. Local or building level technology plans focus on curriculum concerns, teachers, and learners. These plans usually include vision statements and set goals for the use of technology to support the curriculum.

Financial, technical, human resources, architectural, and legal aspects serve as major components of technology planning for state, district, and local schools (Anderson 1996). "Although technology planning occurs at multiple 'levels,' many principles are identical. Planners need to engage the services, creativity, and assistance of all stakeholders" (Anderson 1996). The magnitude of this planning requires people to establish timelines, delegate responsibilities, and constantly evaluate the plans during the building and implementation phases. Peterson (1989) indicates that school board members and district administrators may not know the steps to take in planning for technology in their school systems.

Data Collection

The first course of action for this study began in January 2000, by initiating two pilot studies: 1) training for parents interested in the use of technology in teaching and learning; and 2) training for teachers interested in increasing their skills in using technology as a teaching and learning tool in their respective classrooms. Every parent in grades Kindergarten through second grade received a letter explaining the purposes for the computer training, when and where the sessions would meet, and what they needed to do to reserve a space in the training sessions. These sessions lasted approximately eight weeks, meeting once weekly from 6:00 p.m. until 8:30 p.m. As demand for hands-on computer time increased, the school library hours were extended from 3:00 p.m. until 9:00 p.m. to accommodate parents who did not have home access to a computer. Parents attending these training sessions completed both pre and post-surveys examining demographic information, technology skill levels and interests, and beliefs regarding the use of various technologies as teaching and learning tools. Field notes from these sessions reflected parent motivations, concerns, visions, and anecdotes relating to experiences their children incurred in the context of using computers in the classroom during the time they attended the participating school.

The second pilot involved training teachers interested in expanding or improving their skills in using technology as a teaching and learning tool. Twelve teachers participated in these training sessions which met two evenings per week for a period of eight weeks. The sessions lasted approximately two and one-half to three hours each. Teachers brainstormed a variety of topics relating to computer use in the classroom and prioritized the order in which the topics would be offered. Teachers attending these training sessions completed both pre and post-surveys examining demographic information, technology skill levels and interests, and beliefs regarding the use of various technologies as teaching and learning tools. Field notes from these sessions reflected teacher motivations, concerns, visions, and anecdotes relating to experiences with students while using computers in the classroom.

All faculty members, administrators, parents, supervisors of instruction, and technology coordinators associated with the participating school received surveys and consent forms. These surveys were subjected to statistical analysis and were coded based on qualitative responses. A primary goal was to try and discern themes or patterns of beliefs and technology use that might provide useful information for the planning of future technology endeavors at the school.

Results

Perhaps the most significant aspects of this study relate to the comparisons of feedback on issues regarding the use of technology in education from the primary stakeholders at the participating elementary school, i.e., teachers, parents, administrators, supervisors of instruction, and technology coordinators. Much published documentation exists dealing with the benefits and barriers schools encounter in their attempts to integrate technology; however, the extensive body of research reviewed for this study did not explicitly provide findings comparing and contrasting the expectations each group of stakeholders hold for the use of technology in an elementary school setting. This study adds to the literature a discussion of views and beliefs of the stakeholders in one such elementary school and sheds light on how a school might more efficiently and effectively plan for future technology expenditures and integrative programs.

Results of this study indicate the discrepancies in beliefs regarding the use of technology as a teaching and learning tool that exist among the various stakeholders at the participating school. Results also point to areas of common goals regarding present and future technology use. Implications exist for future technology plans, professional development for teachers, and ways to remove barriers to using technology as a teaching and learning tool that presently exist.

Summary

The new millennium brings with it the evolution of technology-supported teaching and learning and also the incredible potential for educators to take advantage of incorporating that technology into their teaching. A review of the literature indicates that our society will continue to rely more and more on technology and future generations must possess the skills to use that technology in the workforce as well as their personal lives. Governmental, private, and business sectors of our society recognize the need for schools to help train students and continue to aid schools financially in their quest for computers and other aspects of technology. Teachers suddenly presented with new and unfamiliar types of technology may or may not readily integrate it into the curriculum as they struggle with inadequate or insufficient staff development. Perhaps Donald Norman (2000) says it best when he states, "Technology is not the answer, but proper technology coupled with informed pedagogy, coupled with teachers who are coaches, guides, and mentors, can lead the way".

Current literature related to the use of technology in education provides us with information about how traditional teaching models change with the introduction of computers and other technology. These changes affect technology planning for a school or a school system. Teacher training and professional development for teachers in the use of technology compose the subjects of several research projects. To date no consensus exists regarding the most effective model for such training. While the literature provides agreement that integration of technology into the curriculum is paramount, the methods for training teachers to integrate technology and the methods for adopting appropriate pedagogy remain random with a "hit or miss" approach. Colleges and universities face similar challenges in preparing new teachers to readily integrate technology in their teaching.

The literature also indicates that the people responsible for making critical decisions regarding the implementation and use of technology in classrooms make those decisions without the proper information or background knowledge. States and local school districts must make vital and pressing decisions regarding the implementation of technology into classrooms. These decisions must take into account all the stakeholders affected, i.e., teachers, students, parents, administrators, and the community. Understanding the current status of technology use in a school (or school system) constitutes the first step in making these important decisions (U. S. Department of Education 1998).

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Evaluation of Motivation, Interactivity and Learning Styles in Web- Based Instruction and On line courses

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Abstract.
Recently Web-Based Instruction has been adopted for many educational systems in order to support distance education. WBI has become popular in that it overcomes time and space limitation in traditional systems. It is important to provide interactivity and motivation for students besides of assuring understanding and learning. This paper introduces a model used in undergraduate and graduate courses based on web pages and its transition to online courses.. Based on the analysis of the students performances, the paper presents the criteria to evaluate the motivation and interactivity and learning styles of the students, comparing it with the results on these aspects developed in courses on these subjects that were not supported by web pages.

I. Introduction

The Internet has affected the traditional education methodology. Especially with the possibility of the World Wide Web (WWW). Using Web-Based Instruction in Undergraduate courses has helped professors to develop new strategies of teaching and learning in their courses. The first stage of this project was developed on the research of finding new ways of using the WWW for teaching specific contents. The second stage was dedicated to the development of specific web pages to support the traditional learning process, and finally, the teaching on line. The last stage, was developed using the experience of the use of web pages in teaching different courses, and evaluating the impact of the web pages in the learning, learning styles, motivation and interactivity showed by the students.

WBI has changed the traditional ways of teaching and learning. In the traditional perspective, teachers and students share the same space at the same time and also, students may work individually or in groups. On the other hand, in WBI, teachers and students may meet asynchronously using communications tools, such as video and sounds at different places. WBI help students to work in a self-driven manner.

Some of the limitations of the WBI is that the lack of face-to-face communications can affect the perceived satisfaction of the students. Then another important concerns in WBI is how teachers can motivate unseen students. There are some specific ways of motivating and develop interactivity in web pages, and online courses. This paper provides an evaluation model that promotes interactivity and motivation for courses based on WBI and detect learning styles. It is objective and based on principles dominating pedagogical philosophy and learning theory.

This paper is organized as follows. In Section II, related works providing motivation and interactivity are presented. In Section III, the model used is introduced. Based on this model the courses are compared for their interactivity and motivation in Section IV. Finally, conclusions and further research issues are discussed in Section V.

II. Related Work

In (2), the authors argue that course design and the teacher's role might affect student motivation. Based on these arguments, they present three ways to enhance the use of WBI: how to motivate students, course design considerations, and how to motivate instructors.

First, the causes for lack of student motivation include lack of preparedness, lack of funds to purchase electronic resources, initial difficulty in using advanced hardware and software, phobia about technology, lack of background on course, interpersonal difficulty, family illness, etc. The authors suggested the following solutions: get to know the students by providing e-mail addresses: email communications and face-to-face meeting sessions.

Second, as possible course design considerations for providing motivation, the following principles may apply: variation and curiosity, relevance, challenge level. Positive outcomes, positive impression, readable style, and interest. Variation and curiosity refer to providing diversity and making changes in content to stimulate attention and curiosity. Relevance refers to connecting student learning to objectives of the course.

Finally, the authors argued that the motivation problem may also affect teachers, and unmotivated teachers may impact the entire class. In order to motivate the instructors themselves, the following suggestions can be made: more time to redesign the course and develop new strategies to use technology in a meaningful way.

There are three ways of interactions explored in this project: student-course material interaction, student-teacher interaction, and student-student interaction. First, for student-course material interaction, a course should be designed to facilitate self-directed learning, and include many illustrations and guidelines. Second, for student-teacher interaction, teachers need to constantly motivate students. Finally, in order to support student-student interaction, communication tools should be provided.

The model of the web pages and online courses are segmented in the following criteria: a) content, b) graphics, sound, c) authority, which includes the quality of the web page writer, and copyright and trustworthiness of web management organization, d) currency, which refers to whether the web pages' content is up-to-date or not, e) general appearance, which refers to the attractiveness of the web page, and f) ease of navigation.

Motivation is evaluated by considering the following aspects: a) attention, relevance, confidence and satisfaction. Attention is determined by the interest or curiosity of the students. Thus students are supposed to answer yes on questions like "Does the display provide curiosity?" or "Does the content invoke curiosity?". Relevance is the applicability of the content to real life or other subjects. Confidence is to describe the students level of understanding of the course material. Finally, satisfaction is to provide the students' satisfaction after the course, including fairness in grading, positive rewards and psychological impacts.

II. Proposed Model

This proposal tries to develop some objective evaluation criteria that can be useful for WBI designers and teachers. Here the categories to be evaluated are: student-to-course content relationship, student-to teacher relationship, and student-to-student relationship. The evaluation criteria for interactivity include elements inducing student reaction. The evaluation criteria for motivation include elements that stimulate student interest. The elements for interactivity and motivation are somewhat overlapping. The evaluation model may not be an absolute index for WBI 'products, but it can be used for comparing the relative performance of web pages.

Constructivism emphasizes the learner's intentions, experience, and cognitive strategies. According to constructivism, learners construct different cognitive structures based on their previous knowledge and what they experience in different learning environments. Thus, constructivists are supposed to have learning environments that are as rich and diverse as possible. Constructivist also believe that knowledge does not exist outside the minds of human beings and that what we know of reality is individually and socially constructed based on the learner's previous experience. Also, they believe that learning consists of acquiring viable strategies that meet one's objectives, and learning can be estimated only through observation and dialogue.
The evaluation model for interactive and motivation consists of three relationships: Student-to course Content, Student-t-Teacher, and Student-to Student. Within each relationship, a number of elements that may affect the relationship are identified. Each element is given a score of 1 if it exist and 9 otherwise. Formulas based on the scores given to these elements for all three relationships are derived to evaluate interactivity and motivation.

1. Interactivity

1) Student-to-course content relationship

- Providing hyperlinks or directions
- Providing scrolls
- Providing multimedia data, graphic, pictures, maps, charts
- Question/Answer (Trouble Shooting) guide
- Is there any exercise for the course?

2. Student-to-teacher relationship

- Virtual Office Hour
- Reward (for any achievement such as early submission, etc)
- Providing contact information for the teacher other than office hour
- Providing media for communication (Synchronous/Asynchronous):e-mail, chat-room, Internet phone
- Providing collaboration between students and teacher

3. Student-to-Student relationship
    - Does the work involve learner-to-learner collaboration
    - Providing media for communication: e-mail, chat-room, Internet phone, bulletin board, feedback
    - Providing contact information among students

2. Motivation

1) Student-to course content relationship

- Providing explicit statement of course objectives
- Providing warm-up exercises
- Does the web page include a sequence of lessons for students and /or teacher?
- Providing the background and/or prerequisite courses required for the course
- Providing multimedia data: graphic, pictures, maps, charts
- Providing summary and review
- Does the web page specify updated date?
- Does each icon have a name that is helpful in guidance?
- Does the course web page have any references
- Does the course require students to use their native language?
- Does the web page provide the time to finish the course (or lesson)?

- Does the web page provide the author information explicitly?
- Does the web page have a copyright?
- Are all web site still valid?

2) Student-to-teacher relationship

- Providing reward for accomplishment
- Providing collaboration between students and teacher
- Providing teacher's biography (Picture, phone number, e-mail address, etc)
- Referring response time of student input (questions or comments)

3) Student-to student relationship

- Does the work involve learner-to-learner collaboration?
- Providing media for communication: e-mail, chat-room, Internet phone, bulletin board, feedback
- Does the course require competitions between students in the class?
- Providing each student's picture or biography?
- Providing students with chance to meet each other at least once during the semester?

4) Learning Styles

- Does the work involve learner's learning style preferences?
- Providing media for communication, matches the learning style of the studens?
- Does the course adecuate the material to the learning style of the students?
- Providing feedback, according with learning style preferences of the students?

For interactivity, the degree of overall interactivity, I, is determined by the following expression. We assume that, the bigger the value I, the higher the achieved interactivity for a specific WBI course. This means that, no matter what educational theory each element comes from, we simply assume that the element, with possible different weight, is helpful for achieving overall interactivity. The value of I can be somewhere between 9 and 1.

Where C1, C2 and C3 are coefficients (or weight value), and SCI (the degree of student-to-course interactivity), STI (the degree of student-to-teacher interactivity) and SSI (the degree of student-to-student interactivity) are determined as follows. We assume that the degree of each type of interactivity has higher value as more elements are provide for the type.

Similarly, for motivation, the degree of overall motivation, M, is determined by the following expression. As in interactivity, it is assumed that, the higher the value of M, the higher the achieved motivation for a WBI course, In turn, this means that, no matter what educational theory each element comes from, we simply assume that the element, with possible different weight, is helpful for achieving overall motivation. Also, the value of M can be somewhere between 0 and 1.

The actual coefficients will be evaluated and analysed to consider the impact of those criteria in the development of the webpages.

Institutionalizing Technology in Schools: Resolving Teacher Concerns

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Institutionalizing Technology in Schools: Resolving Teacher Concerns

Technology is a fact of life in the twenty-first century. It is an ever-present reality facing people in all walks of life on a daily basis. The need for technology skills in the workplace and in everyday life has brought about new demands on P-12 teachers to prepare today's students to succeed in their life's pursuits. These demands have forced educators to acquire, use, and teach technology skills; in short, to integrate instructional technology into their teaching methodologies as well as into the content areas they teach. Many teachers have been overwhelmed by this change in instructional focus.

The ultimate goal is to move through the change process and integrate technology into teaching and learning to the extent that it becomes "normal" or institutionalized. Research by Fuller (1969) and Hall (1978) have shown that teachers' feelings and concerns have a direct bearing on their behavior. These concerns must addressed if real change is to be effected.

A question posed by researchers, administrators, and teachers concerns what results P-12 education is receiving as a result of the expenditures for instructional technology acquisitions and staff development (O'Riordan, 1999). With limited funding for technology staff development, it is crucial that training content and methodology meet the specific needs of the P-12 teachers who are being required to change their teaching by integrating instructional technology into their classes. After several years of these attempts, examining the direct responses of teachers' feelings toward this change process should provide some insight into how well these goals are being met.

The teachers in this study responded to the following question: What specific aspects of instructional technology have the greatest positive impact on your classroom teaching?

Procedures

The questionnaire was converted to hypertext markup language (html) and placed on the Internet. Extensive web searches located listservs and newsgroups focusing on P-12 teachers and identified email addresses for school district technology coordinators from all 50 states. The researcher emailed a message to the identified school district's technology coordinator/director, mailing list, and listserv manager, asking them to disseminate the URL for the online instrument to their teachers and members. The responses were emailed back to a specific server, and the data were transferred into a password-protected account.

Methodology

Responses to the open-ended question were coded and categorized using Merriam's (1991) standard qualitative methods. The analysis procedure was designed to identify key words and phrases. The qualitative data from the content analysis of the responses to this open-ended question provides a glimpse into the perceptions that these teachers hold regarding their feelings regarding the use of instructional technology.

Population

The target population for this study was P-12 teachers currently using instructional technology in some form in their classrooms Five hundred six usable surveys were returned with each of the 50 states represented. Respondents represented PK through twelfth grade teachers with bachelors degree through doctorates with years of teaching experience ranging from less than one year to over 25 years. The respondents represented a wide variety of assignments from self-contained classrooms through specific subject areas including Language Arts, Social Studies, Mathematics, Fine Arts, Physical Education, Special Education, Foreign Language, Computer Science, Business, and Vocational Education.

Analysis

Five hundred six respondents shared their ideas, concerns, and comments regarding the overall impact that instructional technology has had on them as well as their students' response to technology. The responses to the open-ended question were often lengthy. The respondents' comments naturally grouped into reports of (a) increased student motivation, interest and creativity; (b) a sense of personal and professional empowerment, (c) lack of time, training opportunities, technical support, and equipment; and (d) their perceived roles as technology leaders and trainers for peers. Sample comments from respondents will be provided. The range of comments did not reflect any one demographic factor, interest group, or geographic location. The four distinct categories were well defined in the comments as shown in Table 1.

Table 1

Responses to Open-ended Question

Category	*n*	Percentage
Increased student motivation	212	42
Personal and professional empowerment	128	25
Lack of time, training, support, and equipment	108	21
Technology leadership role	58	12
Total	506	100

The largest number of responses (42%) concerned an obvious change in student motivation, interest and creativity. Many of the teachers referred to their students as being more motivated and more engaged in the learning process than prior to the introduction of instructional technology.

The increased creativity and interest described by these respondents were not limited to the students. A Rhode Island respondent added that when they are encouraged to use technology with their assignments the students are more interested and "that makes my job all the more exciting as well." According to one respondent from South Dakota, "Teaching is much more exciting when the students are so enthused [sic] about learning." Responses indicated that instructional technology integration has had an impact on the creativity and interest of teachers as well as their students.

Increased creativity and heightened interest in students was reported from all over the country in every grade level and subject area. Although some of the respondents made reference to specific software applications and P-12 Internet activities, most of their remarks centered on generic learning creativity reflected by the students, not specific activities and products associated with technology products or programs.

Even though respondents were specifically asked to describe positive aspects of teaching and technology, 21% of the respondents reported problems encountered trying to implement technology in their schools and classrooms. Many of the remarks were included with reports of some successes in spite of the teachers' lack of time, training, technology support, and equipment. Of the 108 responses in this area, 42 reports involved problems with technology training provided by the school or district; 29 respondents reported problems with equipment or lack of technology support; 19 teachers focused on lack of time for technology use or preparation; and the remaining 18 responses included complaints about personnel and scheduling matters. This feedback reinforces similar findings from several researchers (Albaugh, 1997; Becker, 1994; Furst-Bowe, 1996; Treagust & Rennie, 1993; Shearman, 1997) all of whom report that a lack of time for training, support, and equipment inversely impact the effective use of instructional technology in schools.

The majority of the responses about training problems concerned the lack of school or district technology training. Over half of the teachers commenting on the quality or lack of district-provided technology training, reported that they had obtained their technology training on their own.

The 29 teachers whose concerns over lack of equipment and technology support covered everything from outdated and broken hardware, to non-existent or non-responsive technology support in their schools and districts. Their remarks chiefly questioned how they could effectively use their training with no equipment for their students to use. Several teachers commented on the lack of fiscal support in their districts and states, and they added their concerns over no funding increases in the foreseeable future. The respondents who expressed their concerns about lack of time to prepare for and to use the technology feared they would lose the skills they developed in their training. Most of the teachers expressed regret that lack of time prevented them from effectively using technology with their students.

There were 58 teachers who reported increasing confidence and their increasing technology leadership roles in their schools and districts as a direct result of their technology training. These responses fell into two areas involving increased comfort and confidence resulting in innovation and integration of technology into individual classes and delivery of training and technology support to other teachers and administrators.

The group of 128 teachers who reported increased sense of personal and professional empowerment also reported the greatest change in their teaching due to technology training. These comments are similar to those reported by Sheingold and Hadley (1990) as teachers reported that instructional technology enhances their sense of productivity. These respondents described their use of instructional technology with their students and their colleagues. The teachers explained how and to what extent technology training impacted their teaching from increasing technology integration with curriculum delivery to total changes in teaching methodologies.

These teacher comment categories can be compared to the seven Stages of Concern as defined by Hall, George, & Rutherford (1977). These concerns occur in a natural sequence; movement through these stages is developmental. The stages, in order, are 1) awareness, 2) informational, 3) personal, 4) management, 5) consequence, 6) collaboration, and 7) refocusing. The stages are described in Table 2 and compared to the categories of teacher comments derived from teacher comments in this study.

Table 2

Stages of Concern /Comments Comparisons

Stage of Concern	Expression of Concern	Teacher Comment Categories
6. Refocusing	I have some ideas about something that would work even better. Is there a better way? (proactive)	Personal and professional empowerment
5. Collaboration	How can I relate what I am doing to what others are doing? How do others do this? What is the maximum potential of doing this?	Technology leadership roles
4. Consequence	How is my use of the innovation affecting learners? How can I refine it to have more of an impact?	Increased student motivation
3. Management	How can I fit it all in? How can I master this? I seem to be spending all of my time getting materials ready.	Lack of time, training, support, equipment
2. Personal	How will using this innovation affect or impact me? What is my role in this?	________
1. Informational	How does this work? I would like to know more about it.	________
0. Awareness	What is it? I am not really concerned about it. (reactive)	________

From the perspective of Hall's concerns based theory, institutionalization of an innovation (making it "normal" in the environment) only occurs when most of the individuals within a population have resolved (lowered) their concerns on Stages 1, 2, and 3. In order for any innovation to become an integral part of an organization, strong Informational, Personal, and Management concerns must be resolved (Hall, George, & Rutherford, 1978). The results of this study provide some indication that institutionalization has not yet occurred. "If these early concerns remain intense, then the user is apt to modify the innovation or their use of the innovation, or perhaps discontinue use, in order to reduce the intensity of these concerns" (p. 13).

Many encouraging, positive reports of successful use of technology were reported by teachers across the country. However, even when specifically asked to describe positive aspects of their technology-related experiences, twenty-one percent of the respondents in this study volunteered strong, negative concerns that parallel Hall's (1976) Stage 3 (Management). With frequent focus on the needs of students, teacher concerns and needs are often lost. While care must be taken in generalizing the results from this sample, the results of this study provide some evidence that if technology is to become a normal part of classroom instruction, attention must be given to the persistent, personal concerns of teachers.

Comparison of Measures of Achievement and Interactive Technology Use in Distance Education

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Abstract: This study analyzed measures of achievement for students enrolled in distance education courses via assessment of final course grades. Various uses of interactive technologies in classes taught via Distance Education methods and traditional on-campus methods were also compared in this study. Further analysis of the type of interaction methods used and frequency of utilization was performed to determine effects of these various methods of interaction on the achievement of the distance student. Certain benefits and drawbacks of each of the various interaction methods analyzed in this study were found for both students and instructors. A positive correlation was found between the two criteria used to determine student success in this study in both Distance Education and "traditional" courses. Differences were observed in the use of interactive technologies between Distance Education and "traditional" courses.

Introduction

Providing coursework via the Internet and other technology has become the focus among instructors in both K-12, 2-year, and 4-year schools, colleges, and universities in the last few years, though distance education via such methods as correspondence courses has been around for decades. Various forces, including accreditation agencies, government officials, administrators, and even students and faculty, have challenged the effectiveness of these courses and programs. A range of approaches has been used to determine the effectiveness of these courses and programs. Overall, the most frequent approach is by means of a comparison of the courses taught via Distance Education to the same courses taught "traditionally" (on-campus). Many studies (Souder, 1993) present data in which courses offered through distance education methods have higher student course ratings than traditional, on-campus courses in such areas as achievement on examinations, while other studies (Egan, Sebastian, and Welch, 1991) present cases in which courses taught through distance education methods result in lower student ratings on particular course characteristics, such as class organization. Multiple factors have been analyzed in these comparisons to determine success or failure of the distance education program, including maintenance of funding, faculty development and support, faculty satisfaction, and numerous student variables. There is no question as to whether differences occur; rather, accepting that differences exist between distance education and traditional courses, it is the goal of those individuals participating in distance education to assure that these differences reflect a positive change, rather than a negative.

Student Achievement

Three major variables are typically associated with student achievement, or success in distance education courses (Phipps and Merisotis, 1999). The foremost of these variables is student grades, from which data are normally drawn from the students' final grades in a course. A second variable associated often with student achievement is student attitudes toward the distance education course. Some questions that are often asked of students, based on this variable, are "Was the course presentation successful?" or "Do you feel that you learned useful and applicable material through this method?" and finally, "Could you have learned this material better in a traditional course?" A third variable of student achievement deals with overall student satisfaction toward the course. Generally, these questions are phrased using a Likert scale, or something similar. A question from this variable may be, "On a scale of 1 (worst) to 10 (best), rate this method of education." Unfortunately, it is often left unnoted that many students overall satisfaction, attitudes, and final grades are unobtainable due to "dropping" the course. Also, many students may fail to make any contact or may make only infrequent contact with their instructors in some forms of distance education, and therefore may be given failing grades. Data obtained from situations such as this is not valid because it may be influenced by outside variables such as students' lack of familiarity with technology or outside environmental influences, rather than students' true achievement level.

Interaction

A recent study from the National Education Association (2000) stated that as high as 96% of faculty (n=402) teaching through distance education use some form of interactive technology for one-on-one communication with students, predominantly e-mail. One of the many significant findings from this report stated that "faculty with frequent student interaction...give their distance learning courses higher ratings in meeting the goals NEA has determined are essential to quality education." Various other types of interactive technology cited include telephone, chat rooms, threaded discussion groups, or face-to-face meetings. Multiple angles of distinction exist within these interactive technologies. One important distinction is between synchronous (real-time, such as chat) and asynchronous (delayed-response, such as email and threaded discussion) communication. Another important facet of these communication strategies is whom the communication is with: this may consist of student-instructor, student-student, or student-material.

Method

An analysis of interactive communication technology usage was performed on 17 online courses (n=6 graduate; n=11 undergraduate) offered during a full college term. Courses were analyzed for usage of three major communication tools available, including e-mail, a synchronous "Virtual Chat" (VC), and an asynchronous threaded "Discussion Board" (DB). Analysis was performed by evaluation of usage data from course platform available via system administrator access to these online courses. Data was also collected from instructors of traditional courses to determine frequency and use of interactive technology.

Further, two unique courses were being offered in multiple formats simultaneously during this term. One course (c1) was being offered both as a traditional on-campus course, and also separately as an online course. The second course (c2) was being offered through three separate formats simultaneously: traditional, online, and telecourse. (The telecourse was taught via videocassettes, distributed to students during an initial class meeting). Data was collected from these courses' online component, based on the type of interactive technology used, were gathered and compiled into the original 17 courses; further, final course grades for students in these courses were obtained and analyzed for between-group differences.

Data from an online (n=200) and a telecourse (n=11) survey were also collected anonymously and used for further analysis of the results. Students submitted the online survey via the Internet, and all entries were automatically collected into a database for further analysis. Telecourse surveys were completed anonymously in hard copy, and returned by mail to the data analyst. Data was then entered into the online database for compilation and analysis. Questions of interest from the survey for this study include a comparison of the appropriate course type (either online or telecourse) with traditional for "student/instructor interaction" and for "concept acquisition". Choices for these questions were either "better than traditional courses", "about the same as traditional courses", and "worse than traditional courses". A final question, "What effect did this course have on your contact with your instructor?" was also investigated. Answer choices for this question were either "positive", "neutral—neither positive nor negative" or "negative". All surveys were given to students during a time period within the last 3 weeks of class.

Results

Interactive Technology Usage

From the 17 online courses analyzed, 7 (42%) were seen to use DB. Of those using DB, number of topics (forums) created for the course varied from 3-28. Number of student responses (postings) to each forum varied from 1-146, with the average number of postings for each forum was 41. Postings were generally student-student, rather than instructor-student. However, forums must be initially created by instructors, so preliminary questions or postings were always initiated by the instructor. Thereafter, students suffered no restrictions as to the number of postings they were allowed to make per forum. Only 4 of the online courses used VC (24%). Of those courses using VC, the courses consisted of 8, 6, 6, and 5 VC meetings total. Each VC meeting lasted approximately one hour. Of the 17, only 2 courses (12%) used *both* DB and VC to communicate. VC sessions were generally instructor-led clarification periods in which the students were allowed to request help with specific problems they were encountering in the course. All courses analyzed for this study used e-mail to communicate, and instructors report a high number of e-mail from online students. Instructor-reported usage of interactive technology in traditional classes revealed that the majority of student contact instructors by either face-to-face or telephone, and only a very small percentage use email. A minute number of instructors reported using some form of interactive technology equivalent to email or discussion boards, while none reported using interactive technology equivalent to synchronous chat.

Achievement

Between the two courses offering simultaneous methods, largely varied results were found among courses in relation to students' final course grades. Of the first course, c1, an abnormal grade distribution was found to be present. Grades fell exclusively into either an "A" category or an "F" category in the online component. This data varied slightly in the traditional c1 course, yet the majority of grades still fell into the "A" category. Course c1 used e-mail and the DB communication function frequently within the online component, and used only email as a mode of interaction in the traditional component.

COURSE: C1	A	B	C	D	F	I/DROP
Online	74%	0	0	0	26	12%
Traditional	84%	4	2	4	7	2%

■ *Table 1: Percentage of students' final grades and drops or incompletes in "c1"*

Course c2 offered a more normal distribution among grades in comparison to c1. Students grades were highest, consecutively, in telecourse, traditional course, and online. Students in the online component had a significantly lower number of "A's" than their counterparts in either the telecourse or the traditional course. Concurrently, higher class drops or incompletes were found in the online component than in the traditional or the telecourse component. The traditional component of c2 had slightly less than ½ the number of drops or incompletes than did the online component.

COURSE: C2	A	B	C	D	F	I/DROP
Online	3%	27	30	23	17	33%
Telecourse	28%	19	56	0	19	26%
Traditional	16%	34	25	13	13	18%

■ *Table 2: Percentage of students' final grades and drops or incompletes in "c2"*

Further data from a survey completed by online students showed that 80% of students rated the course as having either "about the same" or "better" student/instructor interaction than traditional courses. Additionally, "concept acquisition" received 90% response for "about the same" or "better" than traditional courses. One question, "What effect did this online course have on your contact with your instructor?" received 56% response "positive", 36% "neutral—neither negative nor positive", and 7% "negative". Student comments pertinent to these results include:

I appreciate that distance learning is up to me and that my responsibility is to keep up with the course... As always, learning is up to the student, and I did learn!

It was more convenient and I felt that I had better, as well as easier, access to my instructor...

I liked the class, but felt like (professor) could have interacted more with students...

I loved this class. The teacher was wonderful, the students were great, and we all interacted more so than I have in any other class. I would gladly do this again.

Comments 1, 2, and 4 were from students who participated in a course using DB, VC, or both. Comment 3 is from a student participating in a course using only e-mail.

Data obtained from students participating in a telecourse revealed that 72% rated their course as "about the same" or "better" than traditional courses on student/instructor interaction. The same percentage, 72%, rated concept acquisition as "about the same" or "better" than traditional courses. For the above question, "What effect did the (telecourse) have on your contact with your instructor?", 36% of students responded "positive", 18% "neutral", and 45% "negative". One student stated:

Cassette courses are extremely instructor dependent. Very good this time, but I have had bad experiences in the past due to limited instructor and video availability.

Further student comments stated that many of the students did not even watch the videotapes, but studied textbooks only. Students were clearly not engaged with one another or with the instructor at the same level as in traditional courses, or in distance education courses utilizing interactive technologies.

Discussion

Currently, instructors are trained on how to construct courses, focusing mainly on the technical aspects rather than instructional design and communication issues. This trend is beginning to change at the university used in this study, but slowly and with quite a bit of opposition from individuals who, surprisingly, are supporters of distance education. Many instructors hold fears of having control tighten over their teaching methods, and therefore do not appear to be quite so open to new methods of communication. The pattern appears to be this: once instructors try one form of interactive communication aside from email, they quickly notice student responses take on a more positive tone. From this point forward, instructors are more likely to engage in interactive technologies such as threaded discussion boards and synchronous chats. Interaction is clearly a necessity for the majority of students to succeed in distance education courses, so advances must be made to enable and encourage these instructors to take advantage of the interactive technologies present.

Interaction is often the key in many traditional college-level courses that require independent thinking. In distance education, *every* course requires independent thinking, as evidenced by student comments from the anonymous survey. It is not surprising that the NEA (2000) stated faculty rated their distance learning courses higher and more compliant with quality standards when interactive technology is used. This seems to be an essential element not only for the instructors to keep track of the student's progress in the course, but for the student to receive feedback, both from his instructor, as well as from his classmates. Discussion board interactivity could be equated to a traditional course's class discussion. Many times these class discussions serve to clarify concepts for students, or help the instructor focus on topics that students are most interested or having the most trouble with in class. Outside of this typical environment, students continue to demand this feedback and cooperative learning experience. One recent and interesting study focused specifically on the effects of immediacy of response from the instructor in an online course on student's perceived concept acquisition (Baker, 2001). The results of Baker's study found a strong positive correlation between the perceptions of instructor immediacy of response to students with affective learning ($r=.73$, $p<.01$).

Another finding of the NEA (2000) showed that a very small percentage of distance education courses that were not web-based (online) used chat rooms (15%) or threaded discussion groups (22%), while a much more substantial percentage (62% for both) of web-based courses used chat rooms and threaded discussion groups. This data appears to correlate with the findings of this study, in that the online courses are more likely than other distance education methods to use these methods of interactive technology.

It is interesting to note that four of the seventeen online courses studied in this research used DB for student-instructor and student-student communication, but did not use the VC function. These classes left the VC function enabled, meaning the students were able to browse or "drop in" to the VC room, even though there was no session underway. An archival function present in the course platform for these online courses records each instance of a student entering the chat room, including any comments the students may make. It appears to be significant that courses with students using the DB but not VC function *always* had students drop-in to the VC rooms, and many times students would leave comments such as "hello, anyone here?" Though these students did not understand how to use the VC rooms, they were clearly open to or curious about these chat rooms. This is perhaps a case where the use of one interactive technology, the discussion board, launched them into looking for other methods of communication, similar to the pattern in which instructors jump from using only one interactive technology to many. Students appeared to go in search of other methods of interaction when they were participating in the DB, whereas those students not participating in DB had virtually no drop-ins into the VC area. Hence, is could be assumed that these students not exposed to a form of interactive communication other than e-mail were less likely to search for other ways to communicate with fellow students and with their instructor. This yields the idea that areas of interactive communication, such as with the VC and DB, should be open or enabled to the students without instructor-mediated conversation, perhaps as a student-student study session.

Also of interest are the grades in the c2 course, in which both the online and traditional components have approximately normal grade distributions. However, no form of interactive technology other than e-mail was used in this course. Students gave lower overall course ratings on c2 than on c1, but appeared to receive grades on a more "normal" scale than in course c1. It is possible that intervening variables such as teaching style, student familiarity with technology used, and many more could have produced these peculiar results. The grades of the c1 course show a bimodal distribution, with the majority (74%) of students receiving an "A" in the course. This leaves an astounding percentage (26%) of students to receive an "F' in the course. Comparing this "F" grade distribution in c1 to that of the traditional component of this course in which only 7% of students received an "F" grade, a major distinction is observed. Again, intervening variables could be at play, and these results must be taken cautiously. However, the results do indicate that several major between-course, and instructor-dependent factors may be influencing student success and satisfaction in distance education courses.

Conclusions

Student outcomes in distance education courses are the primary concern of most of the advocates and opponents of these non-traditional courses. Faculty, administration, students, and many others hold concern for equitable learning in distance education courses. It is essential to determine what the crucial elements are that must be present for students to obtain an excellent education. The move is underway to go from a number-focused to a more success-focused orientation in most higher education institutions, and soon, the rest will follow. The issues of interaction and student success will clearly continue to be on the forefront of this discovery.

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Exploring the Effectiveness of Two Models of Technology Integration in a Pre-Service Teacher Education Program

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Abstract

This research study examined whether or not integrating technology throughout a sequence of teacher preparation courses was an effective model for ensuring that pre-service teachers graduate with the knowledge and skills needed to integrate technology in their own teaching. The central question addressed in this investigation was: Is there a significant difference between the level of concerns related to technology integration for preservice interns who enrolled in an introduction to technology course and preservice interns who were exposed to technology integrated throughout all of their teacher preparation courses? The results of this study show that preservice teachers still resist the use of technology as a learning tool even after models of technology use are integrated across all of their teacher education courses. However, the results also demonstrate a shift from the preservice teachers focusing on concerns about how technology will impact their role as teachers to concerns about technology's impact on their students' learning.

Theoretical Framework

The inclusion of technology into elementary teacher preparation programs has become a necessary and important component in most, if not all, teacher education programs. Traditionally, schools of education have prepared their teacher educators to integrate technology through the use of a single technology course focused on skill development with some discussion about teaching with technology. (Topp, 1996). However, it is unreasonable to expect that novice teachers will have the skills and knowledge necessary to effectively integrate technology in their own classrooms after taking only one course (Jensen, 1992).

For the past ten years the integration of technology into teaching methods courses has been suggested as an effective model for helping teacher education candidates develop a vision of the role of computers in an integrated curriculum (Brownell & Brownell, 1991; Willis, 1997). According to Carroll (2000), it is important for teacher education faculty to model technology proficient instruction in courses where pre-service teachers are acquiring the subject matter expertise they will use in the classroom. With this model in mind, colleges of education are working to develop the technology skills and knowledge of their faculty (Thompson, Hansen, & Reinhart, 1996; Sprague, Kopfman, & de Levante Dorsey, 1998; O' Bannon, Matthew, & Thomas, 1998; Sprague & White, 2001). Despite these efforts, little research has been done to show that integrating technology into all teacher preparation courses is any more effective than the traditional technology course.

Teacher Preparation Program

During the 1998-99 academic year, a state-supported institution located in a highly diverse urban/suburban region near Washington, DC, redesigned its teacher preparation programs in response to changes in state licensure requirements. The redesign involved changing from early childhood (PK-grade3) and middle (grades 4-8) education licensure programs to an elementary (PK-6) licensure program. In the original early childhood and middle education programs the course, "Introduction to Educational Technology" was the only course in the programs that focused on technology and was taken at the beginning of the sequence of teaching methods courses. During the development of the elementary program, the program faculty decided to eliminate the Introduction to Educational Technology course and integrate technology throughout all courses.

Students admitted in the 1999-2000 Cohort were the last to go through the early childhood program. These students were required to take the Introduction to Educational Technology course that focused on providing students with technology skills and models for integrating technology in the PreK-3 classroom. However, students entered the course with different levels of technology skills. Those who were proficient with technology often indicated that the course moved too slowly while those who were less experienced with technology felt that the course moved too fast. In addition, for many of the students this was their only experience with technology throughout the program. Therefore, it was necessary to focus on teaching with the technology to encourage these students to use technology for more than drill-and-practice activities.

During the elementary program development effort the faculty expressed the belief that technology should be infused into the program and were committed to modeling the effective use of technology to support teaching and learning. Consequently, a portion of the content from the original Introduction to Educational Technology course was placed in two specific courses, an Introduction to Elementary Curriculum, the first course in the program sequence, and an Integrating Technology into Elementary Curriculum, the last course in the program sequence. Program faculty agreed to integrate technology into content area methods courses that were sequenced between the first and last courses. A faculty member who had expertise in integrating technology in K-12 curriculum (and had been responsible for the technology course that was eliminated) worked to ensure that technology skills needed to complete assignments across all of the teaching methods courses was provided in the first course. In the final course, Integrating Technology into Elementary Curriculum, students were exposed to theoretical frameworks such as, constructivism, integrated curriculum and cooperative learning for integrating technology into a variety of content areas. Students enrolled in 15 credit hours of method courses between these two courses. In these courses, students were exposed to technology appropriate for the specific content area. Students admitted in the 2000-2001 Cohort were the first students to enroll in the new Elementary Education Program.

Instrumentation

During the first week of classes, students in each Cohort were administered the Stages of Concern Questionnaire (SoCQ) (Hall, George, and Rutherford, 1998). This instrument consists of 35 statements related to perceptions about an innovation. The statements were modified to use "technology" instead of "innovation." Students were then administered the same instrument at the end of their program of study.

The SoCQ is based on a seven stage developmental model: (0) Awareness, (1) Informational, (2) Personal, (3) Management, (4) Consequence, (5) Collaboration, and (6) Refocusing. Respondents rate the degree to which each item reflects their feelings using an 8-point Likert scale that ranges from "Irrelevant" or "Not true of me now" (0) to "Very true of me now" (7). According to the model, as individuals move from unawareness or nonuse of technology into beginning or highly sophisticated use, their concerns shift from being most intense at Stages 0, 1, and 2 to most intense at Stages 3, and ultimately to most intense at Stages 4, 5, and 6.

To score the questionnaire, the statements were collapsed into the seven categories. The responses were converted to percentile scores. Each individual's highest percentile score was circled. If the highest score appeared twice, it was circled twice. The mean percentile scores for each of the seven stages were computed for each group's pre and post questionnaire. The results were graphed in order to obtain a profile for each group (Hall, George, Rutherford, 1998).

Results

Forty-two students were enrolled in the 1999 Cohort. Forty students completed the pre-questionnaire and post-questionnaire. The average age of this group was 35 years and there was one male student. In the 2000 Cohort, 48 students completed the pre-questionnaire and 37 students completed the post-questionnaire. The average age of this group was 30 years and there were three male students.

The highest stage of concern on the SoCQ pre-questionnaire for both the 1999 and 2000 Cohorts was Stage 1, Informational. A high score (Very true of me now) on such statements as "I have very limited knowledge about technology" and "I would like to know what the use of technology will require in the immediate future" reflected concerns at the Informational Level. (See Figures 1 and 2 for graphs of the results.) For both groups, the second highest level of concern was Stage 2, Personal. A high score on such statements as "I would like to have more information on time and energy commitments required by technology" and "I would like to know how my role will change when I am using technology" reflects concerns at the Personal Level. Responses on all other stages of concern were low. This profile is typical of a nonuser of technology.

On the post-questionnaire for the both the 1999 and 2000 Cohorts Stage 2, Personal was equal to Stage 1, Informational. The overall profiles still resembled that of non-users. In this instance, personal concerns (Stage 2) appear to override concerns about learning more about technology (Stage 1). That is, these groups are more concerned about their position and well-being than they are about learning more of a substantive nature about technology (Hall, George, Rutherford, 1998).

The highest stage of concern on the SoCQ post-questionnaire for the 2000 Cohort was Stage 6, Renewal. A high score (Very true of me now) on such statements as "I would like to revise my use of technology" and "I would like to modify our use of technology based on the experiences of our students" reflects concerns at the Renewal Level. When this occurs one can infer that the group has other ideas that they see as having more merit than the use of technology. Any high scores in Stage 6 in a non-user profile should be interpreted as a potential warning that there may be resistance to the use of technology (Hall, George, Rutherford, 1998).

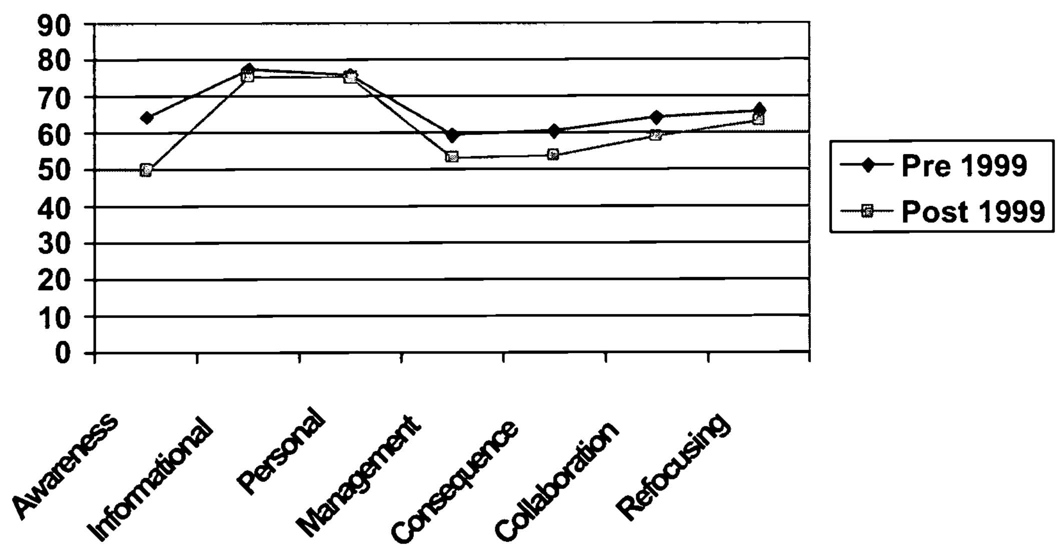

Figure 1: Pre and Post Scores on the SoCQ for the 1999 Cohort

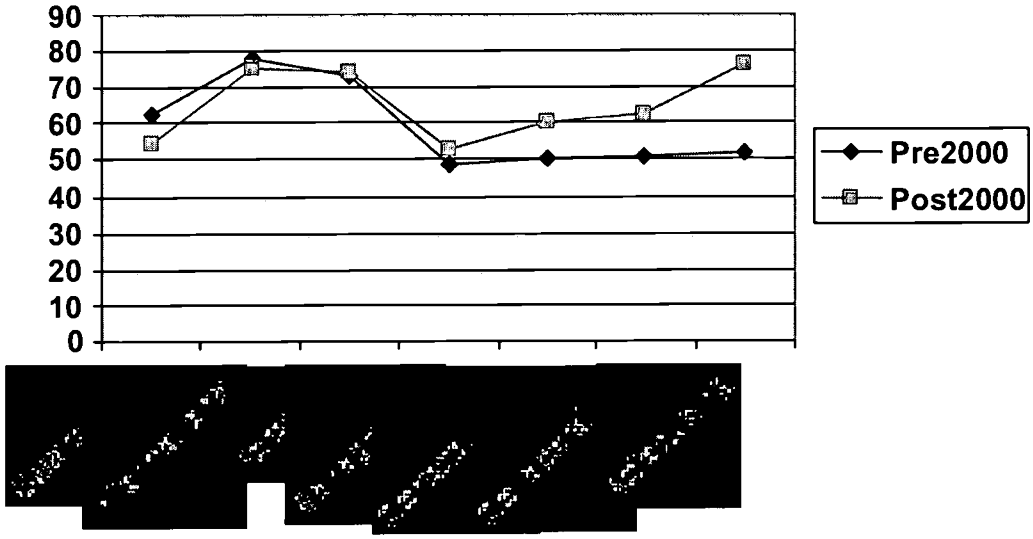

Figure 2: Pre and Post Scores on the SoCQ for the 2000 Cohort

Discussion

Although both posttest profiles are those of a non-user there are some interesting trends accruing in the 2000 Cohort, the group that experienced technology integrated across all of the courses. There is a rise in level of concern in the areas of Consequence and Collaboration. A high score (Very true of me now) on such statements as "I am concerned about how technology affects students" and "I am concerned about evaluating technology's impact on students" reflect concerns at the Consequence Level. The Collaboration Level contains such statements as "I would like to help other faculty in their use of technology" and "I would like to know what other faculty are doing with technology." High scores in these two areas show a shift from the preservice teachers focusing on concerns about how technology will impact their role as teachers to concerns about technology's impact on their students' learning. They are also showing a willingness to work with colleagues to improve the potential of technology. Such a trend demonstrates that these preservice teachers are beginning to make the shift from technology as a productivity tool to technology as a learning tool. They are starting to see the potential of technology to enhance the learning process. However, more time and opportunity to practice what they are taught in their education courses is needed to enable them to overcome their initial resistance to technology.

Research has shown that shifts from Awareness and Informational concerns to Consequence and Collaboration concerns can occur among inservice teachers who study the potential of technology in a four semester graduate level cohort program (Norton and Sprague, 1996). Inservice teachers have the opportunity to practice and experiment with the activities and models taught in their teacher education courses. They are able to understand which models are effective and which need modification. They see the value of constructivism and student-centered activities because they have the opportunity to try them in their classrooms. For preservice teachers to also have the chance to test these models, teacher education programs must work closely with K-12 schools to ensure preservice teachers have the opportunity to teach with technology in their field experiences (White and Sprague, 2002). Such opportunities could help preservice teachers move past their initial resistance to technology and accept it as a learning tool designed to enhance the learning experience.

Conclusion

On the surface, the results of this study seem to challenge the belief that the integration of technology into teaching methods courses is any more of an effective model for promoting the role of computers in an integrated curriculum than the traditional technology course. However, a closer examination of the data does reveal that preservice teachers who experience technology integrated across all courses do begin to make the shift from concerns focusing on how technology will impact their role as teachers to concerns about technology's impact on their students' learning. Opportunities to practice the models presented in their teacher education courses could enable them to overcome their resistance and embrace technology and its potential to enhance the learning experience. Therefore, teacher education programs must work closely with K-12 schools to ensure preservice teachers have the opportunity to teach with technology during their field experiences.

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The Use of Qualitative Methods in Program Evaluation: Elephants can be Elegant

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Guba in 1978 described the benefits of moving away from the use of quantitative methodology in the field of program evaluation, and replacing this approach with qualitative methods to greatly enhance the information shared with decision-makers. Since that time, many professionals in the field have embraced the use of qualitative methods, however, because these designs personalize the data collection process for the respondents, they present both unique benefits and challenges.

The purpose of this paper session is to present information on the qualitative methods being used to evaluate the Modeling Instruction with Modern Information and Communication technologies Project (MIMIC) that is funded through the federal PT3 grant program and housed in the College of Education at Cleveland State University. The goal of MIMIC is to increase the integration of technology into pre-service teacher preparation courses, thus ultimately enhancing the use of technology by future teachers. Current K-12 teachers, proficient in the use of technology in the classroom, serve as mentors to university faculty and support them in learning new ways to use hardware and software as educational tools. Although there was a need to monitor this project's activities through quantitative methods, each of the MIMIC mentor/mentee teams had an interesting story to tell about their experiences that could only be captured using a qualitative approach.

MIMIC's qualitative data collection system will be described, consisting primarily of monthly logs and personal reflective journals. Presenters will provide an overview of the procedures followed to implement the system and discuss modifications that were made based on insights gained during the first full year of implementation. The benefits of qualitative data collection will be examined as well as the challenges faced in using this type of methodology for program evaluation.

Throughout the presentation and paper, benefits of qualitative data collection will be highlighted through the sharing and description of samples of the rich descriptive data from the MIMIC Project. These samples show the struggles and triumphs of faculty members and their classroom teacher mentors as they search out the most effective educational technologies to teach specific content and then work to integrate those technologies into teacher education courses. As noted, however, benefits did not come without challenges as the MIMIC evaluation team attempted to manage the timely flow of data from a diverse, creative, busy group of individuals. The authors will share how these challenges were met in ways that ultimately enhanced and supported the data collection process, and provided timely formative feedback to the MIMIC staff. Those attending the session will have an opportunity to read "the story of MIMIC" in a handout that shows how qualitative data can indeed provide unique insight into how technology project goals are being met.

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Children's Use of the Internet at Home

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Perspective
How do school children use the Internet at home? The answer to this question is critical since an increasing number of young children are accessing the Internet on a daily basis. Growing up with the Internet, children nowadays constitute a constant presence in cyberspace. Statistical data show that young children who are on-line are more likely to log on at home than at school. In the year 2000, it was estimated that more than 55 million households owned personal computers. Almost 20 percent of all digital media users were children.

The Internet provides rich information resources and has the potential for transforming children's learning. While the Internet opens new horizons for learning, it, at the same, poses extraordinary challenges to Internet users, especially to young users. The information on the Internet is unfiltered. The absence of information filters, such as editors and peer reviewers, shifts responsibilities of evaluating information to Internet users. In addition, the information on the Internet appears in multimedia formats including graphics, sound, animation, video clips as well as text, which further complicates the user's process of judging the authenticity and credibility of that information.

Presently, there is little research about how children interact with Internet resources. Although the Internet can be a wonderland for children's learning, it can be a messy, confusing, and dangerous ground. It is imperative that we have a better understanding about how young children use the Internet so as to develop effective strategies to guide their exploration in cyberspace. "Without sound research, there is a tendency to react to the headlines and hype of the moment - and that tack may not result in wise school policymaking and parental oversight."

The Study
This study is designed to investigate how sixth graders in a school of the United States used the Internet resources at home; their perceptions about Internet resources and related issues such as parental supervision and guidance they received for their Internet uses; the search strategies they used, and the teachers' role regarding children's Internet use.

Research Instrument
A survey questionnaire was developed and reviewed by a panel of experienced school teachers and experts in the field. The survey questionnaire was then revised based on the panel's comments and suggestions.

Data Collection
The sample population consisted of all the sixth graders in a school in the United States. The survey was administered in late September 2001. All the sixth graders in the school participated in the survey. Altogether 404 surveys were collected, among which, 171 children indicated that they were Internet users and accessed the Internet at home.

Data Analysis
Data was analyzed by using SPSS (Statistics Package for Social Science). The descriptive method was used for preliminary data analysis. Descriptive research is often used to report the characteristics of the studied sample at one point in time. As Gall and Borg (1996) pointed out: "Descriptive studies in education, while simple in design and execution, can yield important knowledge" (p. 376). Frequencies were calculated to generate baseline data on how school children interacted with the Internet resources.

Results
Gender was balanced among the Internet users in the survey with 85 (50%) male children and 86 (50%) female children. Frequency distribution showed that the highest Internet use was to play games (56%), followed by accessing information for school work (47%); downloading materials unrelated to school work (32%); engaging in other activities such as reading for entertainment and doing shopping (29%). Children

reported that they accessed the websites recommended by their family members such as bother, sister and cousin (45%); friends (44%); parents (43%) and teachers (19%).

Children turned to the Web for resources because it was fun to search for information on the Web (73%). Their major information search strategy was to use search engines by typing in keywords (68%). Approximately 56% of children perceived that the information on the Web is most likely accurate while 16% of the children disagreed and 28% of the children were undecided. These children would use a piece of information if the web page looked attractive (64%). While 40% of the children indicated that inappropriate materials (naked pictures, information on how to make bombs, etc.) made them feel curious, 52% of the children noted that inappropriate materials on the Web bothered them.

While 60% of the children believed that their parents had adequate knowledge to advise them in the use of the Internet, only 22% of the children reported that their parents frequently supervised their Internet use. About 33% of the children noted that their parents discussed with them their concerns related to using the Internet. Children had low confidence in their teachers' knowledge to guide them in the use of the Internet (35%). Only 11% children reported that their teachers discussed their concerns with them related to Internet use. Approximately 80% of the children agreed that the Internet provides important resources for learning and should be integrated into the curriculum.

Implication of the Study

This study generated useful information and provided insights on how young children interact with Internet resources. Although the highest use of the Internet was to play games, there was a positive indication that quite a number of these young children were taking advantage of the wonderful resources on the Internet for their school work. These children supported the integration of the Internet into the curriculum and understood that the Internet can play a great role in developing their intellectual skills. This positive trend needs to be supported and encouraged. Teachers and parents can recommend children educational and age-appropriate resources to maximize the children's learning opportunities on the Internet.

Although these children's understanding of the importance of Internet resources to their education indicates a level of sophistication for their age, they were naive in their judgment of the quality of Internet resources. A large number of these children perceived that the information on the Web was most likely accurate. These children indicated that they would accept a piece of information if the website looked attractive, thus confusing visually appealing web pages with the quality of the content. It is a great challenge for schools and parents to educate young Internet users to become critical readers and to acquire skills on how to evaluate Internet resources.

The most troubling finding of this study was the low parental and teacher involvement in supervising and guiding the children's Internet use. Although the majority of children trusted that their parents had adequate knowledge to provide guidance, most parents never or rarely supervised their on-line children. Parents have a major role to play in protecting their children from the potential exposure to inappropriate materials on the Internet. Inappropriate materials on the Internet can be harmful for young children. Parents can surf together with their children, model the appropriate use of the Internet, discuss with their children the responsible use of the Internet, or consider installing filtering programs to help sift through information.

Schools need to share its role in guiding children's Internet use. This study found that teachers played a disappointingly limited role in this regard in the eyes of children. It might be that teachers themselves did not have adequate knowledge about the Internet. Schools should offer workshops to teachers to train them to become effective Internet users. In addition, schools should organize workshops for parents to help them develop strategies to guide their children's use of the Internet. More importantly, schools need to educate children to become their own guardians in the use of the Internet.

Technology Resistance and Barriers: "Baby Steps" to Online Courses

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Abstract: A simple, step-by-step approach to overcoming barriers to online course development and technology use in education is outlined. The "Baby Steps" approach is effective dealing with several of the barriers to technology use.

Introduction

Administrators in university educational settings must face and deal with faculty resistance to information technology usage in the teaching profession. Faculty reasons or explanations for resistance toward technology usage in classroom teaching or online course development are considered valid issues or criticisms: much time is required upgrading classes with technology, technology equipment is not always available or reliable; some course content is not always suited for newer technologies, etc. However, many of the reasons for not using informational technologies have their root in emotional and/or psychological habits. This paper will address some of the barriers that prevent faculty from incorporating technology into the classroom. By making use the structure of Blackboard, an online course management software system, a systemic approach to dealing with individuals will learn how to use technology in the classroom and online course development.

Many people have difficulties using new technologies. For some the stress of using new technologies and computers, specifically, has caused apprehension and fear. This fear of technology has been termed, "technophobia". In investigations of technophobia, Weil and Rosen (1987) found three techno-types: (1) Eager Adopters, (2) Hesitant "Prove its" and (3) Resisters. This article will focus on the resisters/technophobics. Resisters/technophobics avoid technology, want nothing to do with it, and may fear any machine or gadget they touch. As a result of this behavior, they feel embarrassed, intimidated, or shamed due to their lack of knowledge. The natural and expected reaction to fear is to avoid the feared stimulus, in this case technology, and avoidance will reduce fear in the immediate time frame but increase the fear in the long run. The more they resist and avoid technology, the more fearful and anxious they become towards technology. This avoidance method becomes a vicious technology-fear cycle. The fear of technology or technophobia is one barrier that leads to resistance toward using technology in the classroom.

Another factor that leads to resistance to technological use is the human tendency to view the unknown as "of one piece." We have termed this tendency "monolithia", an etymological fraternal twin of "monolithic," which means, "consisting of a single stone." The English language gets this word through French and Latin from Greek. The dictionary definition of "monolithic" that best fits the usage for this paper is "constitutes a massive undifferentiated and often rigid whole." Many times university faculty have a tendency to view online courses and educational technology as monolithic. Faculty perceive technology and its use as a single, insurmountable task rather than a step by step, or piece by piece, learning process. Fear is heightened, and resistance to technology is accentuated.

Faculty members being required to use technology in the classroom and seeing technology as monolithic may exhibit procrastination as well as technophobia. Procrastination or task avoidance involves putting some task off until later. Procrastination is usually interwoven with the need to be perfect, also known as perfectionism, which further prohibits the learning and use of technology. Individuals put tasks off until such time that they can do them perfectly. The psychological dynamic in operation is often anxiety or fear. For example, if the task is completed, they may be evaluated on the task. The individual will be forced to realistically find out how well they did in the task. This process is difficult for some people to handle. So we may avoid tasks outright or strive to be so perfect that it is put off or worked on until in our minds it is perfect. Naturally, this often results in the task never being completed. Fritz Perls (1992) termed this anxiety "stage fright." An actor does not know after performing whether the audience's response will lead to applause or rotten tomatoes being thrown at the actor.

Technophobia, monolithia, and procrastination are all related to habits of mind and emotion. Monolithia is a thinking problem, whereas technophobia and procrastination involve the emotion of fear. The fourth and fifth barriers to using technology in the classroom are low motivation and reactance. Psychological reactance is defined as the tendency to oppose any action or suggestion on the part of another that would restrict our behavioral freedom. Or put more colloquially, "no one likes being told what to do." Humans exhibit varying levels of reactance. Low motivation and reactance are less related to emotion and more related to individual behavioral patterns. When dealing with faculty exhibiting low motivation and reactance to technology it may be more difficult to change these behavioral patterns. Low motivation is evident when an individual does not have enough mental or physical energy and/or drive to complete a task. In the case of an individual who has both mental and physical energy and/or drive to complete a task and does not do so, this is commonly referred to as "laziness". Reactance tendency is very common among individuals; however some individuals exhibit a stronger reactance tendency than others. An important realization about these five barriers is that very rarely do they occur in isolation; usually some combination of the barriers occurs.

Understanding basic psychological principles can help faculty overcome the barriers that may be preventing them from using technology in the classroom. Joseph Wolpe (1958) postulated that anxiety or fear could not be present in a person at the same time as relaxation and serenity. Fear is the autonomic nervous system arousal that is a preparation for fighting or fleeing – the "fight or flight" response. This notion that fear and relaxation cannot occur simultaneously Wolpe termed "reciprocal inhibition". In effect, fear inhibits relaxation and vice versa. This is hardly a surprise. But out of this idea he developed a clinical technique for reducing fear, which he called "systematic desensitization". The individual, whose fears brought them for help, constructs a "fear hierarchy", with the help of therapist, which consists of images or stimuli that are graded in terms of the fear they evoke. Generally, the hierarchy consists of items that gradually lead to, and are in some sense related to, the most feared of the items down to least feared item. The individual is asked to imagine the least fearful of the hierarchy until they feel fear, then begin a relaxation exercise until the fear is gone. By the process of working up the fear hierarchy the individual finds that they can relax even while thinking of the most feared of the hierarchical items. A later development related to systematic desensitization is "*in vivo* desensitization," in which a person learns to relax in the presence of the fear producing stimuli rather than using images of feared stimuli. Through these techniques fear of technology can be reduced, and individuals can start to learn to use technology without the experience of fear.

In addition, a technique similar to systematic desensitization can be very effective helping people better manage their time. Alan Lakein (1989), the well-known time management specialist, writes that people can use the "Swiss cheese" technique when working on a task. This approach involves working on small pieces of a task or project (baby steps) until the whole is completed.

To help individuals resolve the barriers that prevent them from mastering and using technology in the classroom and/or putting classes online, we have devised an approach we term "Baby Steps", which is a step-by-step method using Blackboard. Blackboard is an online course management system that is widely used and available commercially. We could just as well use WebCT or another software package. Blackboard is the system in use on our campus. The step-by-step hierarchy found below includes putting course syllabi online, links to websites relevant to the course, e-mail usage for class members, build tests online, online grade book, using the discussion board, and using the virtual classroom. The hierarchy of tasks moves from the simple and quick to the more complicated and time consuming. Blackboard's software application is a simple but potentially very powerful method for teaching and desensitizing faculty to technology use. In addition, Blackboard illustrates many other technological learning tools for working in different areas of computer technology. This learning experience can result in reducing or resolving barriers concerning computer technology.

The step-by-step approach addresses each of the barriers that we have identified as important in educational settings. It can reduce anxiety regarding technology use, help people get past seeing technology use as monolithic, reduce resistance in poorly motivated or reactant individuals, and reduce procrastination because so little is asked at any point.

Hierarchy

First the faculty member must logon to Blackboard then click on "control panel." The tasks in each step below are accessed from this page.

1. Put the course syllabus online.

This step requires only 3 clicks and the completion of 5 fields if the syllabus is on a disc. There *is* a browse action required, but this is relatively painless.

2. Add links to interesting websites related to course content.

This step is slightly more time consuming than Step One. It requires that a faculty member know of interesting and pertinent sites and that the URL of that site be typed or copied into a field on a Blackboard form.

3. Email the class members using the email function.

Maybe this one ought to be Number 2, it is so simple. The faculty member clicks on the link, *Send E-mail*, on the Control Panel then types the mail message. Then clicks *Send* and *OK*. This feature of Blackboard is very handy for informing students about a change in class schedule and is one of the most immediately rewarding features of the software package.

4. Post assignments.

This task is virtually identical to putting the syllabus up.

5. Customize the course page's buttons.

This is definitely not for beginners. Various colors and patterns are chosen to heighten the attractiveness of each course's site.

6. Put up the course calendar.

This perhaps requires more work than any step but building tests, but students having a clear understanding of what is required and when it is required reward the effort.

7. Build tests online.

This is getting to the tricky and only bright faculty should attempt this task without supervision. The up side is that tests given online are auto-graded and recorded in the gradebook.

8. Use the online gradebook.

This task would by necessity be completed after an assessment was built and given, and it requires a lot of work, but that work is rewarded by relieving the faculty member of the laborious task of entering grades by hand (and averaging them by hand).

9. Use the discussion board.

This feature is used to have an online discussion, not in real-time

10. Use the virtual classroom.

This is the tough part. This feature is basically a chat room in which the faculty leads a discussion. The Room also has a whiteboard of sorts on which students and faculty can draw. 95% of traditional students today know how to do this. And faculty probably can learn.

Procedure

Faculty members complete the first few steps at faculty meetings held in a computer lab. There they can receive the help they may need from more adept colleagues. People tend to be less afraid in a group, as well. Each step is rewarded with praise and thanks. The praise and thanks, consequences of putting items online, serve as reward for the behaviors of the faculty. The positive natural consequences of using the technology take effect nearly immediately by reduced work load on faculty and improved coordination of educational activities.

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